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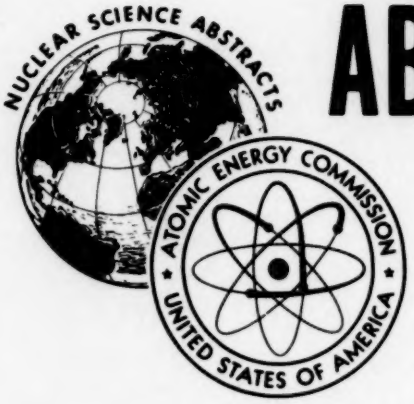

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Volume 30, Number 12 December 31, 1974

NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Analytical and Separations Chemistry

Refer also to abstracts 32350 and 32437.

31461 (UCID-15644-70-2) ANALYTICAL CHEMISTRY QUARTERLY REPORT, APRIL THROUGH JUNE 1970. Harrar, J. E. (Comp. and Ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Jul 1970. 62p. Dep. NTIS $6.25.

Summaries of research in progress at Lawrence Livermore Laboratory are presented. The areas covered include spectrographic determination of trace impurities in U_3O_8, determination of trace niobium in zirconium metal by extraction spectrophotometry, determination of protium–deuterium ratios in biological tissue samples, determination of Ar, Ne, He, Kr, and Xe in air, Auger electron spectroscopy study of cold welding of beryllium, and use of ionization spectroscopy to study reduction of corrosion rates of thorium by surface treatments. (LK)

31462 (UCID-15644-70-3) ANALYTICAL CHEMISTRY QUARTERLY REPORT, JULY THROUGH SEPTEMBER 1970. Harrar, J. E. (comp. and ex.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 26 Oct 1970. 35p. Dep. NTIS $4.75.

Summaries of research at Lawrence Livermore Laboratory are reported including determination of the precision and accuracy of a new spectrographic method for determining trace impurities in U_3O_8. (LK)

31463 (UCID-15644-70-4) ANALYTICAL CHEMISTRY QUARTERLY REPORT, OCTOBER THROUGH DECEMBER 1970. Harrar, J. E. (Comp. and Ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Feb 1971. 42p. Dep. NTIS $5.25.

Summaries of research in progress at Lawrence Livermore Laboratory are presented. The areas covered include determination of deuterium in hydrogen by mass spectrometry, determination of natural-level deuterium by impulse-response NMR, spectroscopy of the actinides, determination of terbium and niobium in pyridinium chlorides by phosphorimetry, and surface properties of beryllium. (LK)

31464 (UCID-15644-71-1) ANALYTICAL CHEMISTRY QUARTERLY REPORT, JANUARY THROUGH MARCH 1971. Harrar, J. E. (Comp. and Ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 May 1971. Contract W-7405-eng-48. 39p. Dep. NTIS $5.00.

Summaries of research at Lawrence Livermore Laboratory are presented including a computer program for calculating H/D ratios from mass spectrometric data and a simple device for obtaining pure hydrogen isotope standards for calibrating an analytical mass spectrometer. (LK)

31465 (UCID-15644-71-2) ANALYTICAL CHEMISTRY QUARTERLY REPORT, APRIL THROUGH JUNE 1971. Harrar, J. E. (Comp. and Ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Aug 1971. Contract W-7405-eng-48. 53p. Dep. NTIS $5.75.

Summaries of research at Lawrence Livermore Laboratory are presented. Included are summaries on spectrographic determination of metals in petroleum, fuel oil, residual oil, and gasoline, determination of natural-level deuterium by impulse-response NMR, an electron microprobe study of beryllium coupons blasted with alumina, and use of single crystals of U(IV) double fluorides as neutron detectors. (LK)

31466 (UCID-15644-71-3) ANALYTICAL CHEMISTRY QUARTERLY REPORT, JULY THROUGH SEPTEMBER 1971. Harrar, J. E. (Comp. and Ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Nov 1971. Contract W-7405-eng-48. 47p. Dep. NTIS $5.50.

Summaries of research at Lawrence Livermore Laboratory are presented including work on electron microprobe analysis of beryllium and spectrographic determination of B, Ba, Be, Cd, Cr, Mn, Ni, Pb, V, and Zn in petroleum, fuel oil, residual oil, and gasoline. (LK)

31467 (UCID-15644-71-4) ANALYTICAL CHEMISTRY QUARTERLY REPORT, OCTOBER THROUGH DECEMBER 1971. Harrar, J. E. (Comp. and Ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 31 Jan 1972. Contract W-7405-eng-48. 78p. Dep. NTIS $7.00.

Summaries of research at Lawrence Livermore Laboratory are presented. Included are summaries on the low-lying electronic configurations of the heavy actinides, the emission spectrum of einsteinium, colorimetric determination of trace iron impurity in beryllium metal, the use of RECOG for interpretation of neutron activation data on copper wire, and modifications in the method for the determination of D/H ratios in the 100 ppm range. (LK)

31468 USPEKHI ANALITICHESKOI KHIMII. (Advances in Analytical Chemistry). Solotov, Yu. A.; Petrikova, M. N. (Eds.). Moscow; Izdatel'stvo Nauka (1974). 368p.

Forty-five articles, reflecting the present status of the analytical chemistry of high purity materials and methods for the determination of small concentrations of elements in solutions and solids, are compiled. Studies on the analysis of small amounts of materials by physical and physical chemical methods are also represented. Individual abstracts were prepared for 14 of the articles. (JSR)

For abstracts of individual papers see: 31492, 31493, 31521–31527, 31541–31543, 31574, and 31575.

Activation and Nuclear Reaction Procedures

Refer also to abstracts 32305, 33852, 33927, and 33942.

31469 (CONF-740655-, pp P9p1-2) CAN INDUSTRY AFFORD TO NEGLECT NUCLEAR ANALYTICAL METHODS? Peisach, M. (Southern Universities Nuclear Inst., Faure, S. Africa). 1974.

From conference on nuclear technology; Cape Town, South Africa (Jun 1974).

The principles of various nuclear analytical methods are briefly described and illustrated i.e. activation analysis, surface analysis by scattering of charged particles and prompt nuclear analysis by means of the emitted particles and prompt x-rays produced by accelerator irradiation. (auth)

31470 (FRNC-TH-496) ANALYSIS OF TRACERS BY X-RAY EMISSION INDUCED BY CHARGED PARTICLES. Foiny, J. M. (Grenoble-1 Univ., 38 (France)). 1973. 97p. (In French). Dep. NITS (US Sales Only) $8.00.

Thesis. Submitted to Universite Scientifique et Medicale de Grenoble (France).

The results of an extensive study of the feasibility of the detection of trace elements from the x-ray emission induced by

heavy charged particles, particularly particles with cyclotron energies, are reported. The principle of analysis by x-ray emission is reviewed and the reasons for the use of excitation induced by high-energy heavy charged particles such as protons and α particles are discussed. A thin-target quantitative analysis method is described by comparison with standard targets. The possibilities of extending the method to thick targets are studied. The factors affecting the sensitivity of the analysis are studied. The results from heavy charged particle excitation are compared with results obtained from fluorescence analysis. Some qualitative and quantitative results are given as examples of the application of this method to the analysis of atmospheric pollution, potteries, and bone. The results obtained led to the conclusion that analysis by x emission induced by heavy charged particle is better adapted to microanalysis or the analysis of the major elements of a sample of very small dimensions than to the analysis of trace elements. (JSR)

31471 (IEA-314) DETERMINATION OF TANTALUM, NIOBIUM, TITANIUM, AND TIN IN PEGMATITE ORES BY NUCLEAR ANALYSIS TECHNIQUES. Garcia Agudo, E.; Duarte, U.; Seignemartin, C. L. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Oct 1973. 16p. (In Portuguese). Dep. NTIS (US Sales Only) $4.00.

The pegmatites of São João Del Rei area, in Minas Gerais, Brazil, are specially rich in minerals containing niobium and tantalum, associated principally to cassiterite. The objective of this work was to show the good possibilities offered by instrumental techniques, like neutron activation analysis and radioisotopic x ray fluorescence analysis for quantitative determination of Nb, Ta, Sn and Ti in pegmatitic concentrates. The distribution of these elements among the different granulometric fractions was also studied. Tantalum was analyzed by neutron activation, and the other elements with x-ray fluorescence, using a 100-mCi ^{241}Am radioisotopic excitation source for Nb and Sn, and a 50-mCi ^{55}Fe source for Ti determination. (auth)

31472 (IEA-327) DETERMINATION OF VANADIUM IN PETROLEUM AND RELATED PRODUCTS BY ACTIVATION ANALYSIS. Passaglia, A. M.; Lima, F. W. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Feb 1974. 19p. (In Portuguese). Dep. NTIS (US Sales Only) $4.00.

Vanadium, at parts per million level, in petroleum, petroleum fractions, and in silica alumina cracking catalyst, was determined by activation analysis. Instrumental determination of vanadium in petroleum was made after 15 seconds of irradiation and the activity of ^{52}V was measured by means of a NaI(Tl) scintillation detector coupled to a 400-channel analyzer. Vanadium in petroleum fractions was also determined using instrumental reactor-neutron activation analysis. Counting was performed by means of a high-resolution Ge(Li) gamma-ray spectrometer coupled to a 4096-channel analyzer. The irradiation time was 5 minutes. In the case of determination of vanadium in cracking catalyst a pre-irradiation treatment of the catalyst by fusion with a mixture sodium and potassium carbonate was necessary. Radiochemical separation of vanadium, after irradiation, was made by solvent extraction. For all irradiations a thermal neutron flux of about 5×10^{12} n/cm$^2 \cdot$ s $\cdot$ was used. According to the results obtained, the analytical method of neutron activation for vanadium in petroleum and distillation products, as well as in cracking catalyst, is a method specific, sensitive, precise and adequate to routine analysis. (auth)

31473 (KFK-1949) COST ANALYSES FOR TERRESTRIAL AND MARINE DEPOSITS EXPLORATION. Comparison of Conventional With Nuclear Analytical in-Situ-Methods. Suppan, A. (Kernforschungszentrum Karlsruhe (F.R. Germany). Abt. Reaktorbetrieb und Technik; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Actiniden). Mar 1974. 35p. (In German). (PACT-49). INIS.

7 figs; 8 tabs.; 6 refs. With abstract.

In terrestrial and marine explorations conventional analytical methods can be supplemented by nuclear in-situ analyses for determination of the concentrations of interesting metals. Such nuclear methods include neutron capture gamma spectroscopy, neutron activation analysis and x-ray fluorescence analysis by means of radionuclides whose physics and technology are explained. The most important component of the technical equipment are the well logging probes. While the probes presented and the associated on-line data processing systems can be used both for terrestrial and marine exploration in shelf areas, the additional equipment is tailored to specific uses. The preconditions for performing cost analyses are calculated. On the basis of various parameters calculation of drilling cost, analytical cost and from these the overall cost is explained. This scheme of calculation and the guide values indicated can be used for preliminary cost estimates. The proper use of cost diagrams is explained by a few selected examples which also allow a cost comparison to be made between conventional and nuclear analytical procedures. The conclusion highlights the proposed development of well logging probes which is intended to further reduce the cost of exploration. (auth)

31474 (NIM-1625) DETERMINATION OF URANIUM AND THORIUM BY THE USE OF DELAYED NEUTRONS. Bibby, D. M.; Chaix, R. P.; Andeweg, A. H. (National Inst. for Metallurgy, Johannesburg (South Africa)). 14 Jul 1974. 24p. Dep. NTIS (US Sales Only) $4.25.

The analytical method developed is based on the detection of the delayed neutrons emitted by some fission products. Limitations in the irradiation facilities at present available result in a limit of detection of 5 ppM of uranium and 3000 ppM of thorium in a 50-mg sample. Two hundred determinations per day can be made, and modifications are suggested to improve this figure. (auth)

31475 (ORNL-TM-4586) STATE-OF-THE ART IN NONDESTRUCTIVE ASSAY SYSTEMS AND THEIR APPLICATIONS TO AN LMFBR AQUEOUS FUEL REPROCESSING PLANT. Shahrokhi, F.; Robinson, J. C.; Mihalczo, J. T.; Ackermann, N. J. Jr. (Oak Ridge National Lab., Tenn. (USA)). Aug 1974. Contract W-7405-eng-26. 83p. Dep. NTIS $5.45.

Thesis. Submitted by F. Shahrokhi to Univ. of Tennessee, Knoxville.

A state-of-the-art study for determination of fissile and fertile isotopic contents of nuclear fuel materials without destruction (nondestructive assay) was performed. The objective was to select and recommend nondestructive assay instrumentation and techniques for the purpose of criticality prevention, safety, safeguards, process control, and accountability throughout a Liquid Metal Fast Breeder Reactor fuel reprocessing plant, namely the Aqueous Fuel Reprocessing Plant (AFRP) proposed by the Chemical Technology Division of the Oak Ridge National Laboratory. (auth)

31476 (PB-232202) DETERMINATION OF CEMENT CONTENT IN SOIL–CEMENT MIXTURES AND CONCRETE. Interim Report, 1 June 1971–1 June 1973. Iddings, F. A.; Arman, A. (Louisiana State Univ., Baton Rouge (USA)). Jul 1973. 64p. NTIS $6.25.

The interim report summarizes the results from laboratory work conducted to establish the necessary analytical parameters for determination of cement content in soil–cement mixtures. The technique of activation analysis using neutrons from an isotopic source was selected for this application. The type, size, and spectrum of the neutron source, the sample size, source-sample geometry, and detector size are the most important parameters determined in this effort. The report also describes other less successful approaches that were explored such as sample analysis using prompt capture gamma rays. Additionally, the suitability of activation and measurement hardware is considered. The laboratory experiments described determined the baseline parameters needed for the required sensitivity and precision. Typical data influencing the configuration of the field system are presented. Design and operational considerations for the field system, especially the activation/shield assembly, follow the discussion of laboratory experiments. One section deals with equipment recommendations with the specific sources of commercially available hardware used in this system being noted. Some preliminary data on the determination of cement in concrete are also given. (auth)

31477 (SGAE-2282) MEASUREMENT AND DISTRIBUTION OF CERTAIN HEAVY METALS IN DANUBE RIVER AND DANUBE CANAL AQUATIC COMMUNITIES IN AREA OF VIENNA. Rehwoldt, R.; Karimian-Teherani, D.; Altmann, H. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie). May 1974. 18p. (BL-96/74). Dep. NTIS (US Sales Only) $4.00.

Samples of mud, water, algae, and fish were collected from the Danube River and Danube Canal and analysed by neutron activation techniques for various trace metals. The study was conducted over a ten-month time period. Results show no significant variation in content of Cr, Co, Sb, Zn, Fe, and Sc during the time period. Comparison of the results obtained for the river to those obtained for the canal indicates that, with the exception of one sampling site, there are no statistically significant differences. Generally the values lie in the range accepted as normal for most freshwater systems. One site in the canal was found to have high Cr content in the mud samples. It is at the point at which the Vienna River joins the canal. (auth)

31478 (UCRL-75757) TRITIUM DEPTH PROFILING BY NEUTRON TIME-OF-FLIGHT. Davis, J. C.; Anderson, J. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Aug 1974. 13p. (CONF-741015-3). Dep. NTIS $4.00.

From 21st national symposium of the American Vacuum Society; Anaheim, California, USA (19 Oct 1974).

A method was developed to measure the depth profile of tritium implanted or absorbed in materials. The sample is bombarded with a pulsed proton beam. Neutron energies from T(p,n) reactions occurring in the target are measured by time-of-flight over a 10.8 m flight path. From the neutron energy the proton energy and thus the tritium depth in the target may be inferred. The measurements were initiated to determine the depletion of tritium absorbed in titanium layers. These layers had served as targets on a 400 keV T(d,n) neutron generator. A spatial resolution of 0.4 mg/cm^2 of titanium (0.9 μm) was obtained. Unlike proton backscattering methods, the technique can be used with thick samples. The sensitivity depends upon the spatial resolution desired and can be as great as 0.1 at. % tritium in host materials. Extension of the method to deuterium depth profiling is possible with the use of the D(d,n) reaction. (auth)

31479 NEUTRON-ACTIVATION DETERMINATION OF Cu AND Mn IN BIOLOGICAL MATERIALS. Gorshkov, V. V.; Mekhryusheva, L. I.; Gorovenko, V. I. (Scientific-Research Physical-Chemical Inst., Moscow). Med. Radiol.; 19: No. 10, 56-60(Oct 1974). (In Russian).

The authors elaborated a simple and quick method of radiochemical excretion of Cu and Mn with sedimentation in the form of thiroxinates with a 2,4-dinitroanilin from the plasma, erythrocytes of the blood, urine and final neutron-activation determination of Cu by ^{64}Cu and Mn by ^{56}Mn. (auth)

31480 ESTABLISHMENT OF THE SIMPLIFIED METHOD OF MERCURY–COPPER AMALGAM DISTILLATION FOR THERMAL NEUTRON ACTIVATION ANALYSIS OF MERCURY. Application for Quantitative Analysis of Mercury in Human Blood. Isono, H.; Kishi, T.; Kanda, Y. (National Research Inst. of Police Science, Tokyo). Eisei Kagaku; 20: No. 1, 41-46(Feb 1974). (In Japanese).

In order to know the background concentration of mercury in biological samples, a quantitative method was established by using the technique of mercury–copper amalgam distillation for thermal neutron activation analysis. One of the advantages for this technique is the use of "copper broom" which was made by bundling 50 pieces of copper wire (0.2 × 50 mm). The other is that mercury was distilled and recovered by heating the Hg–Cu broom in a Pyrex glass tube (5 mm in φ, 7 mm ex φ, 30 cml, one of the ends being closed). It was possible to recover quantitatively 40 mg of carrier mercury in 10 ml of a sample solution with 3–4 bundles of Cu broom. It was found that this method was available for a sample of low mercury concentration. As a result of application to a human venous blood, the value of 23.2 ppB of mercury was obtained by using 0.5 ml of the blood. (auth)

31481 APPLICATION OF ACTIVATION ANALYSIS IN MEDICAL INVESTIGATION AS EXEMPLIFIED BY STUDIES IN SOME PARASITES. Jakutowicz, K. (Agricultural Academy, Warsaw). Postepy Fiz. Med.; 8: No. 1-2, 109-117(1973). (In Polish).

Trace elements were investigated in inverterbrates (cestodes and trematodes) quantitatively and qualitatively by neutron activation analysis. The samples were reactor irradiated. Results are given for cobalt, zinc, silver, barium, and uranium. (auth)

31482 DETERMINING TUNGSTEN CONTENT IN MINERALS BY ACTIVATION ANALYSIS. Khaidarov, A.; Babakhodzhaev, S. M. (Physical-Technical Inst., Kazan). Dokl. Akad. Nauk Tadzh. SSR; 17: No. 5, 28-30(1974). (In Russian).

A 50 to 100 mg mineral sample, and a tungsten standard (2 × 10^{-7} g of W on filter paper) were irradiated at a neutron flux of 1.8 × 10^{13} neutrons/cm^2.sec for 10 hours, and cooled for 3 to 4 days. The unknown mineral and the tungsten standard with 20 mg of tungsten carrier were dissolved in a mixture of HF and HNO_3 (1 : 1). After fuming several times with HNO_3 to eliminate HF, tungsten is eluted from the precipitate with warm ammonia as the ammonium tungstate salt. Two or three extractions may be necessary. Tungsten activity was determined on a pulse height analyzer. The sensitivity of the tungsten determination in minerals is 10^{-9} g. The method requires only 0.1 g of mineral. (SJR)

31483 POSSIBILITIES OF A SENSITIVE ACTIVATION ANALYSIS BY FAST NEUTRONS ON A CYCLOTRON. Akabirov, B.; Abibullaev, N.; Gulyamov, M.; Islamov, B. I.; Muminov, V. A. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 3, 60-62(1974). (In Russian).

Light elements, especially gaseous impurities, are determined with a high sensitivity by activation analysis with the use of charged particles. Neutrons having energies up to 40 MeV can be generated on a cyclotron by a (p,n) reaction on beryllium, which is thermally stable. The energy spectrum and angular distributions of fast neutrons from this reaction were used, and these data were used for the quantitative determination of nitrogen in blood by the ^{14}N(n,2n)^{13}N reaction. The ^{13}N activity with a half-life of 10 minutes was counted on a 256-channel scintillation counter. At a neutron yield of 6.8 n/μc in the front hemisphere the integral flux on the sample surface at an ion current of 10 μ amps was 2.5 × 10^{11} n/cm^2.sec. The sensitivity of the nitrogen determined in this case was equal to 10^{-5} g. On using the (d,n) reaction of Be the neutron yield rose to 10^{13} n/cm^2.sec. Thus, the sensitivity of the analysis can be increased 10^{-7} to 10^{-8} grams. (SJR)

31484 MULTIELEMENT, NONDESTRUCTIVE ACTIVATION ANALYSIS OF BIOLOGICAL SOIL SAMPLES. Rustamov, R.; Orestova, I. I.; Khatamov, Sh.; Kist, A. A. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 3, 63-65(1974). (In Russian).

High-resolution, germanium-lithium counters have made it possible to analyze trace elements in soil and biological samples by activation methods. In determining Al, Ca, Cl, Mn, K, and Na the sample (100 to 200 mg) is subjected to a reactor neutron flux of 10^{12} neutrons/cm^2.sec for 5 to 10 minutes. The content of Al and Ca is determined immediately after irradiation. The Al sensitivity is 8.4 × 10^{-8}%; Ca sensitivity is 1.6 × 10^{-3}; Cl is 6.5 × 10^{-5}; Mn is 4 × 10^{-6}; Na is 1 × 10^{-6}, and K is 1.0 × 10^{-3}%. To determine As, Mo, and Br the sample is irradiated with epicadmium neutrons 5 hr and allowed to cool 24 hr before determining the activity peak. The sensitivity of determining Br is 4.1 × 10^{-5}, As 6 × 10^{-5} and Mo 10^{-3}%. In determining Co, Fe, Sc, Rb, Cs, Sb, Cr, Ta, Eu, and Ba the samples are irradiated for 20 hrs and cooled 30 days before measuring the induced activity. (SJR)

31485 THE DETERMINATION OF CADMIUM, ZINC AND COPPER IN BIOLOGICAL MATERIALS BY MEANS OF NEUTRON ACTIVATION ANALYSIS AND THE ABUNDANCE OF THESE ELEMENTS IN HUMAN ORGANS AND BODY FLUIDS. Kolodzig, P. Muenster, Ger.; Muenster Univ. (1973). 140p. (In German). INIS.

Thesis. 27 figs.; 21 tabs.; with refs. With abstract. Available from the library of Muenster Univ.

In order to determine concentrations of the elements Cd, Cu, and Zn in biological materials, which are subject to physiological interactions in a certain concentration range, a neutron activation analysis method was chosen. Samples of organs and body fluids taken by autopsy from men of different age were used for the experiments. A Hg-amalgam procedure was developed for the purpose of separating the activities of the elements to be measured from the highly activated Na, K, and P isotopes. The neutron-generated Cd, Zn, and Cu activities were determined by means of gamma spectroscopy and the chemical concentrations of elements were calculated by comparison with standards of known concentration, which had been irradiated simultaneously. The results allow some conclusions to be drawn with respect to the distribution pattern of these elements in organs, blood, and excretions as a function of age of the person investigated. (GE)

31486 USE OF RADIOISOTOPES IN CRIMINALISTICS. Kozuka, H. (National Research Inst. of Police Science, Tokyo). Radioisotopes (Tokyo); 23: No. 2, 117-125(Feb 1974). (In Japanese).

The use of radioisotopes in criminalistics, especially activation analysis, is described. The history of the application of activation analysis to criminalistics is mentioned, referring to the origin of the term "forensic activation analysis." Moreover, techniques used for the activation analysis are described. Analyses of poisonous substances of such heavy metals as arsenic and mercury in the living body are explained concretely. In criminal identifications, identifications of hair and of industrial products are explained. The application of radioisotopes, including application of autoradiography in detection of fingerprints and decoding of characters rubbed out, is pointed out. (JA)

31487 MERCURY CONTENT OF FOODS FROM THE GERMAN MARKET. Schelenz, R.; Diehl, J. F. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe (F. R. Germany). Inst. fuer Strahlentechnologie). Z. Lebensm.-Untersuch. Forsch.; 151: No. 6, 369-375(1973). (In German).

7 tabs.; 17 refs.

A method for the determination of mercury in biological material by neutron activation, involving distillation and isotopic exchange, is briefly described. The detection limit of this method is 10^{-10} g Hg. Nearly 150 non-fish food samples altogether had an average mercury concentration of 0.01 mg/kg with extreme values of 0.001 to 0.149 mg/kg. Data are also presented for canned tuna and for several species of freshwater fish. Based on these values and on the average food consumption in the German Federal

Republic the average total uptake of mercury from foodstuffs, beverages excluded, is estimated to be 53 μg per week. This value is far below the amount of 300 μg of mercury regarded by the WHO and the FAO as the "acceptable weekly dose". (auth)

31488 USE OF AN ELECTRON CYCLOTRON FOR THE RAPID PHOTON ACTIVATION ANALYSIS OF ORE SAMPLES FOR GOLD. Kapitsa, S. P.; Martynov, Yu. T.; Sulin, V. V.; Tsipenyuk, Yu. M. Sov. At. Energy (Engl. Transl.); 34: No. 3, 251-253(Mar 1973).
Translated from At. Energ. (USSR); 34: No. 3, 199-200(Mar 1973).

In this method a modification of photon activation analysis for gold is used, based on the use of a short-lived indicator for gold, ^{197m}Au, which is formed as the result of a γ, γ′ activation reaction. The half-life of this isomer is 7.3 sec, and the gamma ray of highest intensity is at 277 keV. (LK)

31489 FEATURES OF ACTIVATION ANALYSIS OF MOVING MATTER USING A FAST NEUTRON SOURCE. Strel'chenko, V. V.; Yakubson, K. I. Sov. At. Energy (Engl. Transl.); 34: No. 3, 254-256(Mar 1973).
Translated from At. Energ. (USSR); 34: No. 3, 201-202(Mar 1973).

The basic concepts of the activation analysis theory of moving matter relative to the study of wells were first published in 1960, in which the exponential character of changes in the intensity of activated radiation with a growth in distance between the γ-quanta detector and the neutron source (probe diameter d) was described. Later experiments indicated that the intensity of the radiation activated by thermal neutrons is dependent on probe diameter and can be best approximated by a function of the type $I_0 e^{-d^2/\Delta^2}$. For a similar type function, I(d, Δ), I. I. Brednev derived the following expression for the intensity of the activated radiation of moving matter (I_N): $I_N = I_0 G = (\sqrt{\pi}/2\nu) I_0 \lambda\Delta\,[1 - \Phi\,(\lambda\Delta/2\nu) - d/\Delta)]\,\exp\,[(\lambda d/\nu) + (\lambda\Delta/2\nu)^2]$, where I_0 is the intensity of activated radiation when v = 0, d = 0; v is the velocity of matter moving in a particular detector; λ is the continuous decomposition of the isotopic indicator; Φ(x) is the probability integral. Analysis of expression (1) indicates that the intensity of the activated radiation, I_N, moving the matter at fixed values of λ, d, and v, depends on the two parameters I_0 and Δ. In turn, parameters I_0 and Δ are functions of a number of variables, including the density and the composition of the matter being analyzed, and the measurement geometry. In the current work, research results are presented regarding the dependence of the I_0 and Δ parameters on the change in media density and measurement geometry during activation analysis using 14-MeV neutrons. On the basis of such results, the problems of optimizing the conditions for determining the composition of moving matter are examined. (auth)

31490 ACTIVATION ANALYSIS OF EXTREMELY SMALL AMOUNTS OF ELEMENTS IN URBAN RIVERS AND UNDERGROUND WATER. Horiguchi, Y. (Tokyo Metropolitan Isotope Research Center). Bunseki Kiki; 12: No. 4, 224-229(Apr 1974). (In Japanese).

This report describes the problems relating to the activation analysis of extremely small amounts of elements in environmental water such as river and underground water, and the experimental cases. In the problems on the method, the extraction of the samples, pre- and post-procedure of samples, irradiation method and detective quantitative analysis by γ-ray spectrometry were generally stated in order. In experimental cases, extremely small amounts of elements were detected by nondestructive activation analysis in order to obtain the state of contamination. Sample water was filtered, concentrated and irradiated. In this measurement Al-Au alloy was used as standard element. Gamma ray spectrometry was done after cooling. As a result, each element (^{28}Al and others) was quantified after irradiation in a short time. After irradiating for a long time, ^{203}Hg and other elements were quantified. Zn, Hg, etc. were extremely detected in the rivers. It was difficult to quantify Cu, which is similar to Cd, in this experiment. In order to study the state in the water, the amount of rare earth element, the amount of each sort of metal elements and the amount of Na, Br and Cl were quantified by activation analysis method with chemical separation method. In addition, the relationship between rivers, sea and the underground water was obtained. (JA)

31491 USE OF SPONTANEOUSLY FISSIONING ISOMERS IN AN INDUCED ACTIVITY METHOD FOR Z ≥ 92 NUCLEI. Aleksandrov, B. M.; Vinogradov, Yu. A.; Zapevalov, V. A.; Lazareva, L. E.; Nedorezov, V. G.; Nikitina, N. V.; Polikanov, S. M. At. Energ. (USSR); 37: No. 2, 154-156(Aug 1974). (In Russian).

It is proposed to use spontaneously fissioning isomers in the study of various nuclear reactions, identification and isotopic analysis of heavy elements. A table of isomer half-lives is presented, and the possibilities of the proposed method are discussed. As an example, the results of determining the ^{241}Am admixture in a sample of ^{243}Am are presented. The experiment was performed on the 50-MeV linac of the Institute for Nuclear Research. Fission fragments were detected by a double multiwire spark chamber. (auth)

31492 RADIOACTIVATION ANALYSIS OF MATERIALS WITH HIGH NEUTRON CAPTURE CROSS SECTIONS. Yakovlev, Yu. V.; Dogadkin, N. N. (Inst. of Geochemistry and Analytical Chemistry, Moscow). pp 124-130 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

A method for the activation analysis of B and Cd, which takes into consideration the absorption of neutrons by the samples, was developed. The concept of the shielding coefficient of the impurities was introduced. A formula was proposed for the calculation of the impurity shielding coefficient on the basis of the B or Cd ratio for the elements being determined. Good agreement was obtained for the experimental and calculated values. (tr-auth)

31493 NEUTRON-ACTIVATION DETERMINATION ULTRASMALL QUANTITIES OF ELEMENTS IN METEORITE MATERIAL. Lavrukhina, A. K. (Inst. of Geochemistry and Analytical Chemistry, Moscow). pp 131-147 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The results of the development of new methods of neutron activation determination of the concentration of 30 elements in different phases of meteorite materials were generalized. The optimum conditions for the instrumental determination of 19 elements in the non-destructive analysis of complex minerals by variation of the radiation conditions and the cooling time were determined. The method used Ge(Li) detectors, a 1024-channel pulse analyzer, and a computer for the analysis of the complex γ spectra. New radiochemical methods for the simultaneous determination of Ru, Pd, Os, Ir, Pt, and Au in ferrous, sulfide, and silicate phases of chondrites and iron meteorites and of P, Se, Tl, Ba, Ce, and Eu in silicate minerals were developed. A method was proposed for the determination of microquantities of U (sensitivity of 10^{-15} g) in metals and other opaque materials by counting the tracks of fission fragments from U. Data were given on the distribution of elements among the mineral phases of meteorites of different types. (tr-auth)

31494 SELECTIVE ACTIVATION OF ALUMINIUM IN THE PRESENCE OF SILICON WITH USE OF A POLONIUM–BERYLLIUM OR PLUTONIUM–BERYLLIUM NEUTRON SOURCE. Belyakov, M. A.; Anchevskii, E. V.; Terent'ev, E. P. Tr. Gos. Nauch.-Issled. Inst. Gornokhim. Syr'ya; No. 23, 110-114(1973). (In Russian).

The neutron-activation determination of Al in geological materials containing Si is based on the nuclear reaction ^{27}Al(n,γ)^{28}Al. The interfering reaction ^{28}Si(n,p)^{28}Al (threshold 4.5 MeV) is suppressed by installing a paraffin-wax moderator (10 to 15 cm thick) between the sample and the neutron source; by this means, an activation ratio of 15 to 20 for Al relative to Si is achieved. A source delivering ≃ 1.2×10^7 neutrons per sec and a NaI(Tl) detector are used, and the irradiation period is 7 min. (Referativnyi Zh.)

31495 NORMAL MANGANESE CONCENTRATIONS IN HUMAN SERUM. Versieck, J.; Barbier, F.; Speecke, A.; Hoste, J. (Ghent State Univ.). Acta Endocrinol.; 76: 783-788(1974).

Plasma manganese concentrations of healthy women were recently published in this journal (Hagenfeldt et al. 1973). It appears that these values (0.18 to 0.32 μg/100 ml) are several times higher than those found in plasma and serum by Cotzias et al. (1966) (0.0587 ± 0.0183 μg/100 ml). The serum manganese levels in 25 normal females and 25 normal males were determined by neutron activation analysis. No significant difference was found between the two groups. The overall concentration average was 0.057 μg/100 ml and the standard deviation 0.013 μg/100 ml. Higher values as reported by other investigators are apparently due to contaminations. (auth)

31496 NEW UTILIZATION OF ^{11}B ION BEAMS. Hydrogen Analysis by ^{1}H(^{11}B,α)α–α Nuclear Reaction. Ligeon, E.; Guivarc'h, A. (CEN, Grenoble, France). Radiat. Eff.; 22: No. 2, 101-105(Jun 1974).

The study of the α particles emitted by the nuclear reaction ^{1}H(^{11}B,α)αα near the resonance of 1793 keV has been used to analyze hydrogen in solids. This work shows that it is possible to detect surface layers less than $\simeq 5 \cdot 10^{13}$ atoms hydrogen/cm^2 and that the profile of implanted hydrogen can be determined to a depth of 4000 Å with a depth resolution about 400 Å. An advantage of this method consists in the use of standard low energy

accelerator (~2 MeV). Comparisons with other nuclear methods are made and several applications are suggested. (auth)

Chemical and Spectral Procedures

Refer also to abstracts 32676 and 34556.

31497 (KFK-1941) APPARATUS FOR SODIUM DISTILLATION FOR ANALYTICAL PURPOSES 'NADESTAN 4'. Borgstedt, H. U.; Peric, Z.; Wittig, G. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Feb 1974. 11p. (In German). INIS.

7 figs.; 17 refs. With abstract in German and English.

An apparatus is being operated for analytical application of the sodium distillation. The apparatus "NADESTAN 4" is part of a process chain comprehending the sodium sampling by-pass of the sodium loop, the pure atmosphere sodium handling box and the distillation device itself. The sodium overflow samples collected in nickel crucibles are distilled in a glass vessel separated from the sodium loop. The sodium is evaporated by induction heating. By the process the sodium metal can be separated from the contaminants, which can be analyzed in the residue of the distillation with high sensitivity. The new apparatus is in use for analyses of sodium samples out of the high temperature corrosion loop, the wear test rig and the tank facility for self welding experiments. The results of oxygen analyses are in good agreement with cold trap temperatures of the loops and the output of emf oxygen meters operated in the same loops. (auth)

31498 (RISO-M-1735) SPECTROCHEMICAL DETERMINATION OF TRACE IMPURITIES IN URANIUM OXIDE BY CARRIER DISTILLATION METHOD USING THE DC ARC CATHODE-CENTRAL REGION. Aziz, A.; Solgaard, P. (Danish Atomic Energy Commission, Risoe. Research Establishment). Aug 1974. 16p. Dep. NTIS (US Sales Only) $4.00.

Spectrochemical determination of various elemental impurities in U_3O_8 is made by direct and carrier distillation method using exposures from full 4-mm arc gap and that from a 4-mm arc strip containing the cathode and central region of the arc from 6 mm arc gap. The spectra from the Cathode-Central region is found free of uranium spectral background and is suitable for quantitative determination of impurities in U_3O_8. B, Cd, V, Fe, Cr and Pb gives reproducible results when 5% NaF is used as carrier in the Cathode-Central region method measurements while 5% AgCl and 5% of the mixture AgCl + NaF (4 : 1) is found a suitable carrier for Ni, Co, Mn, Zn and Mo. AgCl, although good for the visual detection of low level of some elements, is found an unsuitable carrier for quantitative analysis because it creates a heavy background from the uranium spectra. Representative working curves of B and Cd for quantitative analysis are made and at 0.1 ppm concentration level of B and Cd a percent coefficient of variation of ±7 and ±9 is found respectively. (auth)

31499 CONDUCTIMETRIC AND HIGH-FREQUENCY TITRATION OF COMPLEX ZIRCONIUM AND TITANIUM FLUORIDES BY BENZIDINE IN AQUEOUS-ORGANIC MEDIUM. Bausova, N. V.; Lebedeva, E. M. (Inst. of Chemistry, Sverdlovsk, USSR). Tr. Inst. Khim., Ural. Nauch. Tsentr, Akad. Nauk SSSR; No. 25, 158-161(1973). (In Russian).

Results on the conductimetric and high-frequency titration of complex fluorides of Zr and Ti with benzidine in mixtures of water and dioxane and methyl and ethyl alcohols were reported. The sharpest deflection on the titration curve was found at 80% acetone and 98% methyl alcohol. (tr-auth)

31500 EIGHTH NATIONAL CONFERENCE ON ELECTRON PROBE ANALYSIS, NEW ORLEANS, LOUISIANA, AUGUST 13–17, 1973. Bethlehem, PA; Lehigh University (1973). vp. (CONF-720809–). $6.00.

Summaries of the 86 papers are presented. Five are listed individually in NSA. (JGB)

For references to individual papers see: 31501–31504 and 32741.

31501 APPLICATION OF ELECTRON AND ION MICROPROBES TECHNIQUES TO THE STUDY OF NUCLEAR FUELS. Johnson, C. E. (Argonne National Lab., IL). pp 68A-68B of Eighth National Conference on Electron Probe Analysis. Bethlehem, PA; Lehigh Univ. (1973).

From 8th national conference on electron probe analysis; New Orleans, Louisiana, USA (13 Aug 1973). See CONF-730809-.

31502 MICROPROBE EXAMINATION OF IRRADIATED NUCLEAR FUELS. Zeleznv, W. F.; Hutchinson, W. B.; Smith, R. E.; Hakkila, E. A. (Los Alamos Scientific Lab., NM). pp 69A-69C of Eighth National Conference on Electron Probe Analysis. Bethlehem, PA; Lehigh Univ. (1973).

From 8th national conference on electron probe analysis; New Orleans, Louisiana, USA (13 Aug 1973). See CONF-730809-.

31503 ELECTRON MICROPROBE DETERMINATION OF U, Zr, AND C IN MIXED CARBIDE FUEL ELEMENTS. Hakkila, E. A. (Los Alamos Scientific Lab., NM). pp 71A-71C of Eighth National Conference on Electron Probe Analysis. Bethlehem, PA; Lehigh Univ. (1973).

From 8th national conference on electron probe analysis; New Orleans, Louisiana, USA (13 Aug 1973). See CONF-730809-.

31504 MICROPROBE TECHNIQUES FOR THE ANALYSIS OF RADIOACTIVE MATERIALS. O'Boyle, D. (Univ. of Wisconsin, Madison). pp 84A-84C of Eighth National Conference on Electron Probe Analysis. Bethlehem, PA; Lehigh Univ. (1973).

From 8th national conference on electron probe analysis; New Orleans, Louisiana, USA (13 Aug 1973). See CONF-730809-.

31505 SPECTROGRAPHIC DETERMINATION OF TRACE RARE EARTH ELEMENTS IN HIGH PURITY THORIUM. Chang, C. C.; Shih, J. S.; Chang, C. T. (National Tsing Hua Univ., Hsinchu (Taiwan). Dept. of Chemistry; Institute of Nuclear Energy Research, Lungtan (Taiwan)). Z. Anal. Chem.; 270: No. 3, 187-190(Jul 1974).

4 figs.; 2 tabs.; 3 refs.

An emission spectrographic determination of fifteen rare earth elements in thorium was developed, the spectrographic procedure was carried out using a low-current dc arc and using Sc as an internal standard. The rare earth impurities were concentrated with a cation-exchange resin. Very high sensitivity was achieved with a 1 g sample. The detection limits range from 0.01 ωg for Yb to 0.5 ωg for Pr and Nd. (auth)

31506 ARSENATE-IODOMETRIC METHOD FOR THE JOINT DETERMINATION OF PRASEODYMIUM AND CERIUM(IV). Mamedov, I. A.; Guseinova, Z. A.; Nabiev, M. N. Azerb. Khim. Zh.; No. 5-6, 136-138(1973). (In Russian).

An arsenate-iodometric determination of Pr and Ce(IV) in their mutual presence was developed. The determination can be carried out in three variations. In all variations the determination is possible within wide limits of concentration of these metals. The determination takes 30 to 40 min with sufficient precision. (tr-auth)

31507 INTERACTION OF THE THIOCYANATE COMPLEX OF MOLYBDENUM WITH TRIETHYLAMINE IN STRONGLY ACID MEDIUM. Verdizade, N. A.; Melikov, S. R. (Azerbaidzhan Polytechnical Inst., Baku). Azerb. Khim. Zh.; No. 5-6, 113-116(1973). (In Russian).

The complex formation of Mo(V) thiocyanate with triethylamine in strong HCl or H_2SO_4 medium using chloroform as an extractant was studied by extraction photometric methods. The optimum conditions for the formation and extraction of the Mo complex were established. The color develops rapidly and is stable for 4 to 5 hrs. The molar extinction coefficient at 460 nm is $\epsilon_{460} = 2.8 \times 10^4$. With this method 0.2 to 160 μg Mo can be determined with an error of ± 0.6%. (tr-auth)

31508 SPECTROPHOTOMETRIC STUDY OF THE COMPLEX FORMATION OF TANTALUM(V) WITH PYROCATECHOL AND ANILINE AND THE EXTRACTION PHOTOMETRIC DETERMINATION OF TANTALUM. Ali-Zade, T. D.; Gamid-Zade, G. A.; Akhmedova, G. A. Azerb. Khim. Zh.; No. 5-6, 109-112(1973). (In Russian).

Complex formation in the Ta(V)–pyrocatechol–aniline system was studied. The complex is formed by keeping the mixture in boiling water for 5 min. The optimum pH interval for the formation and extraction of the complex is 4.7 to 3.7. The composition of the extracted compound is Ta : ph : HR = 1 : 1 : 1. The molar extinction coefficient is 6800. The extracted complex was stable with time and obeys the Beer law in a wide concentration interval for Ta (10 to 150 μg in 10 ml). (tr-auth)

31509 GLYCINE CRESOL RED REAGENT FOR PHOTOMETRIC DETERMINATION OF SCANDIUM. Akhmedli, M. K.; Gambarov, D. G.; Fati-Zade, R. F. (Azerbaidzhan State Univ., Baku). Azerb. Khim. Zh.; No. 5-6, 101-104(1973). (In Russian).

A complex compound with maximum absorption at 520 to 530 nm and ϵ = 27,500 was formed during the interaction of Sc with glycine cresol red. The optimum pH value for the formation of the complex is 5 to 6. It was established that glycine cresol red reacts with Sc at ratios of 1 : 2, 2 : 1, and 1 : 1 as a function of the wave length and the concentration of reacting materials. The form and charge of the interacting particles were established. The stability constant of the 1 : 2 complex is 3×10^{-19}. The possibility of the

photometric determination of Sc with this reagent was established. The effect of different ions and masking substances on the interaction of Sc with the dye was determined. (tr-auth)

31510 SPECTROPHOTOMETRIC DETERMINATION OF PLUTONIUM WITH CHLOROPHOSPHONAZO III. Yamamoto, T. (Japan Atomic Energy Research Inst., Tokai). Mikrochim. Acta; No. 5, 871-877(1974).

Plutonium(IV) forms a Chlorophosphonazo III complex in 0.5-2 M hydrochloric acid. Maximum absorbance occurs at 620 and 685 nm. Beer's law is obeyed over the range of 0-50 μg per 10 ml and the molar absorptivity is 3.7×10^4 l mol^{-1} cm^{-1} at 690 nm. Plutonium can be determined in the presence of fluoride, sulfate and phosphate. However, lanthanides, thorium, uranium and zirconium interfere seriously. (auth)

31511 EFFECT OF Ga_2O_3 AND NaF ENTRAINERS ON THE VOLATILISATION AND EXCITATION OF VANADIUM IN THE SCRIBNER-MULLIN METHOD. Amaya, C. B.; Guido, O. O. (Comision Naconal de Energia Atomica, Buenos Aires). Talanta; 21: No. 6, 533-537(Jun 1974).

A study has been made of the effect of NaF and Ga_2O_3 as entrainers, on the spectral line intensities of vanadium, and on the sensitivity and detection limits by the Scribner-Mullin method. The two entrainers have different effects on the volatilization of vanadium. By radiotracer methods with ^{48}V, the degree of volatilization was found to be 37% with NaF and 0.9% with Ga_2O_3. Use of NaF greatly increases the sensitivity, lowering the detection limit by a factor of about 50, without affecting the precision. The physiochemical conditions in the plasma do not seem to influence the line intensities with either entrainer. (auth)

31512 NEW METHOD FOR THE SOLVENT EXTRACTION SEPARATION AND PHOTOMETRIC DETERMINATION OF PALLADIUM. Patil, S. P.; Shinde, V. M. (Shivaji Univ., Kolhapur, India). Mikrochim. Acta; No. 5, 853-858(1974).

TBP has been used for the extraction of palladium(II) from hydrobromic acid medium and a simple extraction scheme developed for separation of palladium from Fe(III), Co(II), Ni(II), Ru(III), Rh(III), Ir(III), and Pt(IV). A spectrophotometric method is described for the determination of palladium with 1-phenyl-2-thiourea. The effects due to acidity, solvents, reagent concentration and diverse ions are reported. The complex is probably of 1 : 1 composition. (auth)

31513 SEMIMICRO DETERMINATION OF SELENIUM AND TELLURIUM BY CHLORAMINE-T OXIDATION. Padma, D. K. (Indian Inst. of Science, Bangalore); Shaw, R. A.; Vasudeva Murthy, A. R.; Woods, M. Mikrochim. Acta; No. 5, 849-852(1974).

Finely divided selenium and tellurium undergo oxidation to selenic and orthotelluric acids by a concentrated solution of chloramine-T in acid medium. An analytical procedure (accurate to <1%) was developed based on this reaction. (auth)

31514 SPECTROPHOTOMETRIC DETERMINATION OF Zr(IV) WITH 4(2-PYRIDYLAZO)-RESORCINOL. Nagarkar, S. G.; Eshwar, M. C. (Indian Inst. of Tech., Bombay). Mikrochim. Acta; No. 5, 797-800(1974).

The orange-red complex formed between zirconium(IV) and 4-(2-pyridylazo)-resorcinol (1 : 1) at pH 2.5, in presence of ascorbic acid and phthalate buffer, is used for spectrophotometric determination of zirconium, the absorbance being measured at 540 nm. Beer's law is obeyed for zirconium concentration of 0.5 μg to 5.0 μg per ml. Molar absorptivity is 6.75×10^3. Apparent formation constant (log K) of the complex is 5.664 ± 0.2. The method has sensitivity of 0.013 μg of zirconium per cm^2 and relative standard deviation ±1.30%. (auth)

31515 QUENCHING OF EXCITED METAL ATOMS IN THE UNCOOLED FIELD OF THE CATHODE. Zakharov, E. A.; Myasoedov, B. F.; Ozhegov, P. I.; Karyakin, A. V. Zh. Prikl. Spektrosk.; 21: No. 1, 21-27(Jul 1974). (In Russian).

The effect of nitrogen and hydrogen in discharges with uncooled cathode fields on the intensity of the spectral lines of Fe, Cr, Mn, Ni, Mo, and Cu was studied experimentally. The experiments were carried out at currents from 0.05 to 0.3 amp pressure of the discharge gas of 15 mm Hg. The partial pressure of the composition of the discharge gas was varied. The dependence of the intensity of the metal lines on the size of the discharge current and the input was determined. It was shown that cathode sputtering is the basic process for the intake of the metal atoms into the ir plasma. On the basis of the observed changes in the gas spectra and a comparison of the dependence of the intensity of the lines on the partial pressure of the gases with corresponding changes of the voltage at the discharge gap, an explanation was given for this dependence. It was concluded that in the discharges studied excitation occurs as a result of the collision of the metal atoms with electrons and collisions with particles of the gas: atom-atom and atom-ion collisions. The quenching of the excited metal atoms was explained by collisions of the second type with the gaseous particles. The effect of chemical processes in the cathode-plasma system in the cathode field on the line intensity was observed. (tr-auth)

31516 EFFECT OF CALCIUM, MAGNESIUM, AND SODIUM DURING THE SPECTROGRAPHIC DETERMINATION OF STRONTIUM IN SOLUTION. Ryazanov, I. A.; Aidarov, T. K. Zh. Prikl. Spektrosk.; 21: No. 1, 5-8(Jul 1974). (In Russian).

The effect of Ca, Mg, and Na on the results of the determination of Sr during the spark discharge excitation of its spectrum was studied. The solutions studied contained 1, 10, and 20 mg/l of Sr and the impurities Ca, Mg, and Na were introduced at concentrations from 10 to 5000 mg/l. It was established that additions of Ca, Mg, and Na weak the intensity of the ion lines of Sr which leads to an underestimation of the results. The degree of weakening of the intensity of the lines of Sr depends on the ionization potential and the concentration of the added elements. The smaller the ionization potential and the larger the concentration of the element, then the stronger is its effect. On the basis of the results of the study of the common effects of these impurities the possibility of taking these effects into consideration was studied and the following formula was proposed: $\Delta = 2.3 - C_{Sr} - 0.007\ C_{Ca} + 0.025\ C_{Mg} + 0.05\ C_{Na}$, where Δ is the percent deviation between the experimentally found and known values of Sr concentration, C_{Sr} is the concentration of Sr found in the present of these impurities in mg/l, and C_{Ca}, C_{Mg}, and C_{Na} are the concentrations of these elements in mg/l (determined by chemical methods). The sensitivity of the proposed method for the determination of Sr in solutions is 0.5 mg/l and the relative error does not exceed ±4%. (tr-auth)

31517 USE OF THE NAPHTHALHYDRAZIDE OF ISONICOTINIC ACID FOR THE EXTRACTIVE-PHOTOMETRIC DETERMINATION OF MOLYBDENUM IN STEELS. Podchainova, V. N.; Yatsenko, V. A.; Dolgorev, A. V. (Urals Polytechnic Inst., Sverdlovsk, USSR). Ind. Lab. (USSR) (Engl. Transl.); 40: No. 3, 295-297(Mar 1974).

Translated from Zavod. Lab.; 40: No. 3, 243-245(Mar 1974).

The conditions for the extractive-photometric determination of molybdenum in steels with the hydroxynaphthalhydrazide of isonicotinic acid (NGINA) were determined. Chloroform was used as the extractant. The interfering effects of vanadium (V) and large quantities of iron (III) were eliminated by adding ascorbic acid before NGINA. The relative error of the determination was 3%. (LK)

31518 DIFFERENTIAL SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF RUTHENIUM IN BINARY ALLOYS. Postnikova, I. S. (Inst. for Metallurgy, Moscow). Ind. Lab. (USSR) (Engl. Transl.); 40: No. 3, 298-299(Mar 1974).

Translated from Zavod. Lab.; 40: No. 3, 245-247(Mar 1974).

A differential spectrophotometric method was used to determine ruthenium without its preliminary separation in the following binary alloys: Ru-Sm, Ru-Nd, Ru-Sc, Ru-V, and Ru-Al. The reaction of ruthenium with thiourea was used for the determination. (LK)

31519 CHEMICOSPECTRAL DETERMINATION OF IMPURITIES OF NON-RARE-EARTH ELEMENTS IN LANTHANUM AND ITS OXIDES. Kaplan, B. Ya.; Kirillova, Z. P.; Merisov, Yu. I.; Nazarova, M. G.; Petrova, E. I.; Skripkin, G. S. (State Scientific-Research and Planning Inst. of the Rare Metals Industry, Moscow). Ind. Lab. (USSR) (Engl. Transl.); 40: No. 3, 311-313(Mar 1974).

Translated from Zavod. Lab.; 40: No. 3, 256-259(Mar 1974).

A chemical spectral method for determination of non-rare-earth impurities (Co, Cr, Cu, Fe, Mo, Mn, Nb, Pb, Ta, Ti, W, and V) in lanthanum and lanthanum oxides with a sensitivity of 10^{-5} to 10^{-6}% was developed. The method is designed for the analytical monitoring of the production of lanthanum compounds with increased quality. (LK)

31520 EXTRACTION-PHOTOMETRIC DETERMINATION OF URANIUM IN METALLIC LEAD (EXCHANGE OF EXPERIENCE). Stepanenko, Yu. V.; Bagdasarov, K. N.; Shchemeleva, G. G. (Rostov-on-Don State Univ., USSR). Ind. Lab. (USSR) (Engl. Transl.); 40: No. 3, 321-322(Mar 1974).

Translated from Zavod. Lab.; 40: No. 3, 263(Mar 1974).

The reaction of the uranyl benzoate complex anion with malachite green was studied. The optimum conditions of extraction of the compound obtained with a 1 : 1 mixture of benzene and chloroform were selected. Beer's Law is observed in the range of concentrations from 0.1 to 1.5 μg/ml of uranyl. In the determination of these amounts of uranyl with malachite green, the presence of up

to 1.0 mg alkali and alkaline earth metals, 0.5 mg Mn and Ni, 0.2 mg Pb, 0.1 mg rare-earth elements, 0.05 mg V (V), 0.01 mg Th, Mo(VI), Fe(III), Ce(IV), Zr, and Re(VII) is permissible. Titanium and indium interfere. The impurities Ag, Cu, Sb, Zn, Bi, and As, encountered in metallic lead, do not interfere with the determination. The relative error of the determination does not exceed 4%. (LK)

31521 LOW-TEMPERATURE LUMINESCENT MICROMETHODS FOR THE DETERMINATION OF THALLIUM, LEAD, BISMUTH, AND TELLURIUM. Bozhevol'nov, E. A.; Solov'ev, E. A.; Lebedeva, N. A. (All-Union Scientific Research Inst. of Chemical Reagents and Particularly Pure Materials, Moscow). pp 59-63 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The possibility of the simultaneous determination of Tl, Pb, Bi, and Te by the luminescence of hydrochloric acid solutions at the temperature of liquid nitrogen and by the burst of intensity of the luminescence during the thawing of these solutions from −196 to 0°C was studied. A micromethod for the determination of Tl, Pb, Bi, and Te by the luminescence of the hydrochloric acid at −196°C and during the thawing of the solutions was developed. The sensitivity of the determination of Pb in 0.005 ml of solution is 5×10^{-13} g, 2×10^{-10} g for Tl, 3×10^{-13} g for Bi, and 1×10^{-10} g for Te. (tr-auth)

31522 PHOTOLUMINESCENCE OF CRYSTAL PHOSPHORS FOR DETERMINATION OF MICROIMPURITIES OF LANTHANIDES. Poluektov, N. S.; Efryushina, N. P. (Inst. of General and Inorganic Chemistry, Odessa). pp 64-73 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

Methods were developed for the determination of microimpurities of lanthanides in a series of oxides of the elements of this group and in oxides of Y and Sc. The methods are based on the luminescence of the corresponding crystal phosphors. The effect of the experimental conditions on the sensitivity of the determination was determined. The sensitivity of the method for the determination of Pr, Nd, Sm, Eu, Tb, Dy, Ho, Er, Tm, and Yt in various rare earth oxides is tabulated. (tr-auth)

31523 SPECTROPHOTOMETRIC METHODS IN THE ANALYSIS OF PURE MATERIALS. Goryushina, V. G.; Malyutina, T. M. (State Scientific Research and Planning Inst. of the Rare Metal Industry, Moscow). pp 171-178 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

Some methods for the improvement of the sensitivity of spectrophotometric methods for the determination of impurities in pure materials by using new highly sensitive reagents, ternary complexes, breeding reactions, and effective extractants or their mixtures were examined. Improvements in the apparatus and techniques for the measurements (increase of the optical path length and decrease of the solution volume, expansion of the scale of optical density, use of special attachments to the spectrophotometers, etc) were discussed. The characteristics of the spectrophotometric methods for the determination of microimpurities of 17 elements at concentrations of 10^{-6} to 10^{-7}% in the high-purity material are given. (tr-auth)

31524 EXTRACTION PHOTOMETRIC DETERMINATION OF MICROQUANTITIES OF TANTALUM IN ROCKS. Nazarenko, V. A.; Shustova, M. B. (Inst. of General and Inorganic Chemistry, Odessa). pp 179-183 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The formation of mixed-ligand complexes of Ta with o-oxyfluorone (I) and antipyrine (II) in sulfate solutions was studied spectrophotometrically. The complex is represented by its positively charged compound extractable with $CHCl_3$ in the form of an association with the anions of strong acids. The ratio in the complex is Ta:I:II = 1:2:2. A rapid method for the determination of Ta in rocks using this complex was described. (tr-auth)

31525 RHODAMINE C FOR THE EXTRACTION-FLUOROMETRIC DETERMINATION OF THORIUM. Golovina, A. P.; Runov, V. K. (Moscow State Univ.). pp 184-187 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

It was established that Th ions interact with 5,7-dibrom-8-oxyquinoline (DBO) and rhodamine C with the formation of nonfluorescing ion associations that can be extracted with benzene. The ratio of the components in the association formed is Th:DBO:RhC = 1:5:1. A mechanism for its formation and fluorescent properties was proposed. An extraction-fluorometric method for the determination of Th by quenching its fluorescence was proposed. The sensitivity is 0.04 μg Th/ml. (tr-auth)

31526 DETERMINATION OF SMALL QUANTITIES OF SOME ELEMENTS BY THE METHOD OF AMPEROMETRIC TITRATION. Songina, O. A.; Zakharov, V. A. (Kazakh State Univ., USSR). pp 273-277 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The wide applicability of amperometric titration in the determination of microquantities and microconcentrations of various elements was discussed. Methods of amperometric titration of many elements were systematized and shown in tabular form. Most of the determinations reported were based on the indication of the final point from the anode current of the titrant on Pt electrodes. 54 references. (tr-auth)

31527 KINETIC METHODS FOR THE DETERMINATION OF MICROQUANTITIES OF THE PLATINUM ELEMENTS. Yatsimirskii, K. B.; Tikhonova, L. P. (Inst. of Physical Chemistry, Kiev). pp 306-319 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The value and characteristics of kinetic methods of analysis, their possible use for the determination of microquantities of the Pt metals, and the types of reactions and processes at the basis of these determinations were discussed. A review is given of the studies on kinetic methods of determination of Os, Ru, Ir, Pt, and Pd from 1966 to 1972. 64 references. (tr-auth)

31528 SPECTROPHOTOMETRIC STUDY OF THE SYSTEM THORIUM–CARBOXYARSENAZO–FLUORIDE AND ITS ANALYTICAL APPLICATION. Basargin, N. N.; Levkov, E. G.; Novak, V. P. Ukr. Khim. Zh.; 40: No. 6, 648-651(Jun 1974). (In Russian).

The complex formation of Th^{4+} with carboxyarsenazo was studied spectrophotometrically. At pH 2.0 a complex of the composition (Th):(HR) is formed with λ_{max} = 620 and 670 nm and $\epsilon_{670} = 3.7 \times 10^4$. A rapid selective method for the determination of fluoride ions in the region from 50 to 600 μg was developed. The method was applied to the analysis of the electrolysis dust in the aluminum industry. The error of the determination does not exceed ±1.50%. (tr-auth)

31529 NEW METHOD FOR DETERMINING ION COMPOSITION. Applications to the Exact Measurement of Molecular Masses, and to the Separation of Isotopes and Isobars. Devienne, F. M. (Univ., Nice). Compt. Rend., Ser. A; 278: No. 5, 165-166(28 Jan 1974). (In French).

In order to avoid the use of a high resolution mass spectrograph, a method was developed for separating molecular ions, which can also be used for the qualitative and quantitative analysis of gases, and for the separation of isotopes and isobars. (FR)

Radiometric and Radiochemical Procedures

Refer also to abstracts 32003, 32073, 32203, 32252, and 32635.

31530 (ANL-8060(Pt.3), pp 6-17) RADIOCHEMICAL METHODS. Nelson, D. M.; Yaguchi, E. M.; Waller, B. J.; Wahlgren, M. A. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

The techniques used to measure ^{239}Pu, ^{238}Pu, ^{90}Sr, ^{137}Cs, and mixed gamma-emitting nuclides in samples of fresh water, organisms, and sediments collected from the Great Lakes are described. The radiochemical methods are modifications of published procedures, adapted to the sample type and size and the mixture of isotopes being determined. Generally, these methods are performed sequentially so that all isotopes are determined on a single sample rather than on separate subsamples. (CH)

31531 (ANL-8060(Pt.3), pp 36-38) EFFECTS OF THERMAL ASHING OF CESIUM-137 IN BIOLOGICAL SAMPLES. Yaguchi, E. M.; Waller, B. J.; Griffith, M. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

The destruction of organic material is a general prerequisite for radiochemical analyses of biological samples for low-level fallout contaminants. Dry ashing has been the subject of considerable debate because of the volatility of cesium salts at high temperatures. Because ^{137}Cs in an important long-lived fission product concentrated in plant and animal tissues, the fate of this isotope during a given ashing procedure was investigated. (CH)

31532 (EUR-5158e) DETERMINATION OF THE Pu 240 IN SOLID WASTE CONTAINERS BY SPONTANEOUS FISSION NEUTRON MEASUREMENTS. Application to Reprocessing Plant Waste. Berg, R.; Swennen, R.; Birkhoff, G.; Bondar, Ley, J.; Busca, B. (Commission of the European Communities, Ispra

(Italy). Joint Nuclear Research Center). 1974. 54p. Dep. NTIS (US Sales Only) $5.75. EUR B.FR. 85,-.

A non-destructive measurement system for the passive assay of plutonium in solid waste drums is described. The fission neutrons from ^{240}Pu spontaneous fissions are measured with a system consisting of a flexible well-type counter built up of six modular units, each containing three ^{3}He-counter tubes of 50-cm length, either coupled to a variable dead-time counter containing pulse amplification, -shaping and -discrimination chains for the six neutron detection units, or to a small computer (8K memory) able to do time correlation analyses of the pulse output from the detector units. The computerized part was meant to serve mainly as a reference method for the variable dead-time counter (VDC). The system was calibrated with PuO_2 standards of known isotopic composition, distributed evenly and locally in matrix materials closely corresponding to the matrix material expected in real waste drums. Calibration extended from sub-gram quantities of plutonium to several hundred grams of plutonium. Actual waste drums were measured, of which some contained substantial amounts of fission products giving rise to high gamma doses and other unidentified (α,n)-sources, resulting in a high neutron background. The experimental results from calibration runs are presented along with the results on the actual solid waste drums originating from the oxide production chain of the reprocessing plant. The total amount of plutonium in a drum is obtained from isotopic composition estimates. The theoretical background and the mathematical outline of the theory is given. (auth)

31533 (HASL-286, pp I.11-I.16) ALPHA CONTRIBUTION TO BETA BACKGROUND: A FOLLOW-UP STUDY. Fisenne, I. M.; Keller, H. W. 1 Oct 1974.

In fallout program.

Contributions of α activity to low level natural background radiation were investigated in an attempt to pinpoint the sources. Of primary interest was the reduction of the beta scintillation counter background used during ^{90}Y β measurements. (auth)

31534 (HASL-286, pp I.53-I.70) STRONTIUM-90 IN HUMAN BONE: 1973 RESULTS FOR NEW YORK CITY AND SAN FRANCISCO. Bennett, B. G. 1 Oct 1974.

In fallout program.

Results are presented of determinations of ^{90}Sr content of 229 specimens of human vertebrae obtained during 1973 in New York City and San Francisco. The average ^{90}Sr to Ca ratios for adult vertebrae are 1.35 pCi/gCa in New York and 0.80 pCi/gCa in San Francisco, about 3% less than the average values of the previous year. Average ^{90}Sr concentrations in children's bone are now little different from the adult values. A two compartment bone model, which accounts for both short and long term retention of ^{90}Sr in bone, is used to describe the variations of ^{90}Sr content of bone and provide correlation with dietary ^{90}Sr intake. Regression analysis of the 13 years of survey data provides values of the relative retention of dietary ^{90}Sr and the effective bone turnover rates. The bone model gives satisfactory description of observed ^{90}Sr levels and allows reliable assessment of the long-term behavior of ^{90}Sr in man. (auth)

31535 (RISO-M-1732) TRACE MULTI-ELEMENT ANALYSIS OF BIOLOGICAL TISSUE BY PROTON-INDUCED X-RAY FLUORESCENCE SPECTROSCOPY. Kemp, K.; Palmgren Jensen, F.; Tscherning Moeller, J.; Hansen, G. (Danish Atomic Energy Commission, Risoe. Research Establishment). Jul 1974. 24p. Dep. NTIS (US Sales Only) $4.25.

Development of a sample preparation technique for trace multi-element analysis of biological tissue by proton-induced, x-ray fluorescence spectroscopy is described. The samples, which were sections of liver tissue from rats and guinea pigs, were found to be representative of the liver with respect to element content. More than 20 elements were simultaneously determined in the liver samples, and the detection limits for the heavy elements, i.e., Cr, Ni, As, Se, Sr, Mo, Cd, and Pb, were 0.2-2 ppM in dry matter. (auth)

31536 (SSI-1974-007) METHOD FOR DETERMINATION OF LONGLIVED RADON DAUGHTERS IN WATER AND BIOLOGICAL SAMPLES. Suomela, J. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Jan 1974. 17p. (In Swedish). Dep. NTIS (US Sales Only) $4.00.

A method for analysis of the amount of lead-210, bismuth-210, and polonium-210 in water and biological materials was tested. The method is based on electrodeposition and following measurement of the radioactivity of the plats. The chemical yield for both bismuth-210 and polonium-210 is over 90% after three hours electrolysis. The smallest detectable activity for the three radionuclides may be estimated to 0.1 pCi for 900 minutes measuring time. (SW)

31537 (UCRL-51577(Pt.2)) SYSTEM FOR PLUTONIUM ANALYSIS BY GAMMA RAY SPECTROMETRY. Part 2. Computer Programs for Data Reduction and Interpretation. Gunnink, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Apr 1974. Contract W-7405-eng-48. 98p. Dep. NTIS $5.45.

With the use of a computer-based spectrometer system, techniques were developed whereby the isotopic abundances and total analysis of plutonium can be made by detecting and properly analyzing gamma rays emitted by a solution sample. Isotopic ratio measurements within 0.05% for ^{239}Pu and within 0.5 to 1% for ^{240}Pu and ^{241}Pu can be obtained in counting periods as short as 10 minutes. This report describes and lists a set of FORTRAN programs which have been used to perform these analyses. (auth)

31538 NH_4 CINNAMATE AS A REAGENT FOR THE SEPARATION OF ^{7}Be. Bauman, A.; Juras, M. (Institut fuer Forschungsmedizin und Arbeitshygiene, Zagreb). Mikrochim. Acta; No. 5, 937-940(1974). (In German).

The precipitate of $C_6H_5CH = CHCOOBeOH$ is crystalline, easily filterable, and stable. It is convenient for radiochemical analysis. (auth)

31539 NEW TECHNIQUE FOR FLUORESCENCE X-RAY COUNTING. Raikar, U. R.; Ganatra, R. D. (Bhabha Atomic Research Centre, Bombay). Int. J. Nucl. Med. Biol.; 1: No. 4, 215-216(Jun 1974).

A new method for the detection of trace elements in biological samples was studied, using fluorescent x rays excited by ^{169}Yb and with the exciting source and sample mixed together. Sensitivity of the method for iodine was determined and compared with the results using a conventional ^{241}Am external excitation source. Possible in vitro and in vivo applications of this technique are suggested. (UK)

31540 MINIMUM-MEASURED ACTIVITY AT A CHANGEABLE BACKGROUND. Nenov, I. Khidrol. Meteorol.; 21: No. 3, 47-52(1972).

Almost all measurements are carried out in a more or less natural radioactive background which is not connected with the experiment. That is why it is very important in measuring the activities to establish the background at the time of the measurement. A short description is given of the causes giving rise to a changeable background and the circumstances which should be taken into account when working under such conditions. The way is shown to establish the changeable background and the working formula for its determination are given. Three basic methods of measuring the activities are indicated: full minimum time; equal times of measuring the preparation and the background and equal number of impulses. Formula are deduced for the minimum-measured activity by the three methods, a transitory coefficient being used in deducing the formula. Further, an analysis is made of the obtained formula and a comparison is made with those for A min. at a constant background. By knowing the values of A min. at a changeable background, we can establish the quantity of isotopes needed to create such an activity which could be registered by the apparatus with the necessary accuracy. (Abstr. Bulg. Sci. Med. Lit.)

31541 CONCENTRATION THERMORADIOMETRY AND THERMORADIOMETRIC TITRATION. Tolgyessy, J.; Dillinger, P.; Lesny, J. (Slovakian Polytechnical Inst., Bratislava). pp 97-104 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The principles and preliminary experimental results of new nuclear analytical methods, concentration thermoradiometry and thermoradiometric titration, are described. The methods are based on the use of radioactive inert gases as indicators. The determination is based on the thermal changes in the process of chemical reactions and on the different solubility of the gases with changes in temperature. The method of calibration plots or the titrimetric method was used during the analysis. Examples of acid-base thermometric titration and the determination of the humidity of gases by the method of concentration thermoradiometry were reported. (tr-auth)

31542 NEW ASPECTS OF THE DEVELOPMENT OF RADIOCHEMICAL METHODS OF ANALYSIS. Bilimovich, G. N. (Inst. of Geochemistry and Analytical Chemistry, Moscow). pp 105-123 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

New trends in the development of radiochemical methods of isotopic dilution and activation analysis using the principles of substoichiometry are discussed. A comprehensive summary of work done in this area in the last decade is given. 191 references. (tr-auth)

31543 USE OF HIGH VALENCE STATES IN THE PRECIPITATION AND DETERMINATION OF AMERICIUM AND BERKELIUM. Myasoedov, B. F. (Inst. of Geochemistry and Analytical Chemistry, Moscow). pp 148-154 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The kinetics of the oxidation of trace amounts of ^{243}Am by ammonium persulfate and the effect of different factors on the complete transition of Am to the hexavalent state were studied. The extraction method was used for identification of the valence form. The stability of macroquantities of Am(VI), obtained by the ozone oxidation of tetravalent ^{241}Am in nitric acid solution, was studied. The conditions for the quantitative extraction recovery of Am(V) by alcohol solutions of 1-phenyl-3-methyl-benzoylpyrazolone-5 were determined. An effective method for the separation of gravimetric quantities of Am and Cm by the extraction of Cm by a mixture of extractants from acid solutions containing Am(V) was proposed. On the basis of this method a method for the radiometric determination of Am in solutions of complex composition was proposed. For microgram quantities of Am in standard solutions, a spectrometric method was developed using its light reaction with arsenazo III. The different methods for the oxidation of trace amounts of ^{249}Bk up to the tetravalent state were examined. A simple and effective method for its precipitation in a radiochemically pure form with subsequent use of ^{249}Bk for the continuous precipitation of isotopically pure ^{249}Cf was described. (tr-auth)

31544 DETERMINATION OF POTASSIUM IN MIXTURES OF POTASSIUM CHLORIDE AND BASIC SLAG BY USING NATURAL RADIOACTIVITY. Hall, R. F. (Fisions Ltd., Ipswich, Eng.). J. Sci. Food Agr.; 25: No. 6, 637-642(Jun 1974).

A rapid method is described for the determination of potassium in mixtures containing potassium salts and basic slag. Four Geiger Müller tubes connected in parallel were used to measure the natural radioactivity of ^{40}K and the potassium contents of the mixtures were evaluated from a previous calibration. The effects of variation of particle size of both the potassium source and the basic slag were demonstrated, the count rate varying in different directions as the fineness increases in the two cases. Use of the technique in the production of a mixture of potassium chloride and basic slag has shown that the results from the method were comparable with those of the flame photometer. (auth)

Separation Procedures

Refer also to abstracts 31597, 31601, 31604, 31605, 31607, 31700, 31703, 31714, and 31715.

31545 (BNWL-SA-5067) REVIEW OF ION-EXCHANGE TECHNOLOGY USED FOR THE PURIFICATION OF THE INDIVIDUAL RARE EARTHS. Wheelwright, E. J. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1974. Contract AT(45-1)-1830. 11p. (CONF-741002-10). Dep. NTIS $4.00.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

This brief review is limited to a discussion of ion exchange as a separation process performed on column beds of organic or inorganic exchange materials and does not include such processes as thin-layer and paper chromatography, electrophoresis, solvent extraction, extraction chromatography, or separations based on changes of oxidation state. (25 references) (LK)

31546 (IS-T-651) CHARACTERIZATION AND ANALYTICAL APPLICATION OF AN α-HYDROXY OXIME RESIN FOR CHROMATOGRAPHY. Goodkin, L. (Ames Lab., Iowa (USA)). Oct 1974. Contract W-7405-eng-82. 54p. Dep. NTIS $5.45.

Thesis.

A resin having α-hydroxy oxime functional groups was synthesized. Its characterization and application to the separation of copper(II) and molybdenum(VI) from other metal ions and from each other are reported. (LK)

31547 (ORNL-TM-4529) EFFECT OF EXTENDED EXPOSURE TO SIMULATED LMFBR FUEL REPROCESSING OFF-GAS ON RADIOIODINE TRAPPING PERFORMANCE OF SORBENTS (FINAL REPORT). Ackley, R. D.; Davis, R. J. (Oak Ridge National Lab., Tenn. (USA)). Aug 1974. Contract W-7405-eng-26. 36p. AT.

The effect of extended exposure to simulated LMFBR fuel reprocessing off-gas on the radioiodine trapping performance of certain sorbents was investigated. Satisfactory trapping performance for iodine injected as CH_3I or as I_2 was observed for the following sorbent–operating temperature combinations over exposure times of ≥195 days and for the case of the simulated off-gas not having been specially treated: $\frac{1}{16}$-in. pellets of 26% AgZ (silver-sodium zeolite with 26% Ag^+ for Na^+ exchange) at 200°C; $\frac{1}{16}$-in. pellets of 99% AgX at 100°C; and 8 × 16 mesh (U.S.) granules of GX135 (silver salt-treated alumina-silica) at 100°C. In less-extended testing, satisfactory performance was also observed for 10 × 20 mesh beads of 88% AgX at 200°C. Results were also obtained for the case of exposure to simulated off-gas which had been treated by passage through Hopcalite, an oxidizing catalyst, at 350°C; both beneficial and detrimental effects were observed. (auth)

31548 (ORO-1797-48) TEMPERATURE EFFECTS IN SYNERGISTIC SOLVENT EXTRACTION. Kandil, A. T.; Aly, H. F.; Raieh, M.; Choppin, G. R. (Florida State Univ., Tallahassee (USA). Dept. of Chemistry). [nd]. Contract AT(40-1)-1797. 15p. Dep. NTIS $4.00.

The extraction of Eu(III) and Tm(III) was studied in mixed systems of TTA + TBP and TTA + acetylacetone (AA). The formation constants of $Eu(TTA)_3$, $Eu(TTA)_3(TBP)_2$, $Eu(TTA)_3(AA)$, $Tm(TTA)_3$, $Tm(TTA)_3(TBP)$ and $Tm(TTA)_3(AA)$ were measured as a function of temperature to obtain free energy, enthalpy and entropy changes. The thermodynamic parameters support a mechanism for synergism in which the coordination number of the lanthanide ion expands when $Ln(TTA)_3$ forms $Ln(TTA)_3(S)_n$ where S is TBP or AA. (auth)

31549 (RC-9-1974) EFFECT OF TEMPERATURE ON THE CHROMATOGRAPHIC SEPARATION OF HAFNIUM AND ZIRCONIUM. Arsenie, I. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 9p. (In French). Dep. NTIS (US Sales Only) $4.00.

The effect of temperature in the elution of Hf and Zr in the sulfate form on anion resins was studied. The studies showed a variation of the distribution coefficients with temperature. (tr-auth)

31550 STUDY OF THE STATE OF ^{95}Zr + ^{95}Nb IN AQUEOUS SOLUTIONS. Chekmarev, A. M.; Sinegribova, O. A.; Yagodin, G. A. (Moscow Chemical-Technological Inst.). J. Radioanal. Chem.; 21: No. 1, 129-134(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

The adsorption on paraffin and polyethylene and the paper chromatography in aqueous solutions in the pH range of 2 to 12 were used for the study of the behavior of ^{95}Zr and ^{95}Nb. The effect of complexing ions (SO_4^{2-} and CO_3^{2-}) was studied in the same pH range. The constants of hydrolysis and the composition of hydrolytic species of ^{95}Zr in the solution containing sulfate ions were determined in the pH range of 1 to 2. Paper chromatography was used for the control of the purity of ^{95}Zr after an extractive separation from ^{95}Nb with α-benzoinoxime. The possibility of studying the extraction processes of Zr (without its previous separation from Nb) by reversed phase chromatography is shown. Conditions for the formation of polynuclear compounds of Zr and Nb and their influence on the extraction separation in nitrate media were studied. (auth)

31551 FINAL PURIFICATION AND CONCENTRATION OF AMERICIUM/CURIUM SEPARATED FROM HIGH-LEVEL REPROCESSING WASTE. Haug, H. O. (Kernforschungszentrum, Karlsruhe, Ger.). J. Radioanal. Chem.; 21: No. 1, 187-198(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

A cation-exchange cycle has been developed for the recovery and concentration of the Am/Cm product from a DTPA/lactic acid solution used in an extraction process for the isolation and separation of the actinides from lanthanide fission products. The optimum pH region for the sorption of Am^{3+} from 0.05M DTPA/1M lactic acid solutions by strongly acidic cation-exchange resins is pH 0.9–1.0. Maximum usable capacities, heights of the exchange zone, and concentration factors for different resins, cross-linkages and temperatures have been determined. Decontamination factors are given for some fission products, as well as U, Np and Pu. (auth)

31552 SEPARATION OF FOUR PLATINUM METALS BY ANION-EXCHANGE IN HYDROBROMIC ACID MEDIUM. Dybczynski, R.; Maleszewska, H. (Inst. of Nuclear Research, Warsaw). J. Radioanal. Chem.; 21: No. 1, 229-245(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

Distribution coefficients of Pt, Ir, Pd, and Rh in the systems Dowex 1 $[Br^-]$–HBr plus 0.0035M bromine and Dowex 1 $[Br^-]$–HBr plus 2% $N_2H_4 \cdot HCl$ were determined with the aid of radioactive tracers by batch equilibration for the resins of nominal cross-linking 2, 4, and 8, respectively. Column experiments showed that Dowex 1X4 should be used for separations because of the favorable dynamics of the column process. Elution conditions for the quantitative separation of both trace and milligram amounts of Ir–Pt, Rh–Pt, Pd–Pt, and Ir–Pd–Pt mixtures are given. Some data on the effect of temperature on the quality of separation are also presented. (auth)

31553 ANION-EXCHANGE IN MIXED SOLVENT SYSTEMS. V. Separation Scheme for Fifteen Radionuclides by Ion-Exchange. Szlaurova, M.; Koprda, V.; Fojtik, M. (Research Inst. of Industrial Hygiene and Occupational Diseases, Bratislava). J. Radioanal. Chem.; 21: No. 1, 211-216(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

A quantitative separation scheme for Zr, Nb, Mo, Sr, Ba, Y, Ce, Sc, Cs, Eu, Mn, Cu, Co, Fe, and Zn is presented. The scheme is based on group separation by means of anion-exchange resins using mixed solvent systems and subsequent separation of the groups into individual components by means of change of both eluting agent and resin type. The optimum working conditions for separation are established. Separation procedures are of good reproducibility and practically quantitative. (auth)

31554 ANION-EXCHANGE IN MIXED SOLVENT SYSTEMS. VI. Kinetics of Ion-Exchange. Koprda, V. (Research Inst. of Industrial Hygiene and Occupational Diseases, Bratislava). J. Radioanal. Chem.; 21: No. 1, 217-227(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

The diffusion of cobalt chloro complexes in anion-exchange beads was studied in mixed solvent media. The effects of variables on the kinetics of the exchange process by the batch technique were examined. The strongly basic anion-exchanger Dowex 2X8 in its Cl^- form was used in ethyl alcohol–water–hydrochloric acid solutions. The rate laws were verified experimentally. The dependence of the exchange rate on the temperature, the viscosity of the solution, the mean resin particle diameter, and the composition of the solution was studied. (auth)

31555 INFLUENCE OF THE GEOMETRY OF THE STATIONARY PHASE ON THE EFFICIENCY OF EXTRACTION CHROMATOGRAPHIC SYSTEMS. Specht, S.; Nolte, R. F.; Born, H. J. (Technische Univ., Munich). J. Radioanal. Chem.; 21: No. 1, 119-127(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

The importance of the extraction medium and its film geometry to the separation efficiency is illustrated by the example of the chromatographic extraction systems HDEHP-HCl-Eu^{3+} and TBP-HNO_3-Sc^{3+}. Starting from the geometry of the matrix, the effects of the exchange kinetics and flow pattern were experimentally proved. Exchange kinetics are described as a heterogeneous transport-limited reaction in the aqueous phase. Four ranges of the rate of exchange with the geometry of the matrix (pore diameter) were found. The flow patterns in the chromatographic layer can be established by the individual pore cross-sectional area of the matrix. The sum of the effects of exchange kinetics and flow patterns determines the chromatographic efficiency of the systems. Their relative effects in the two systems being investigated are discussed. (auth)

31556 INVESTIGATION OF SOME CHROMATOGRAPHIC SUPPORT MATERIALS FOR EXTRACTION CHROMATOGRAPHY OF URANIUM AND FISSION PRODUCTS WITH TRIBUTYL PHOSPHATE. Hermann, A.; Huebener, S. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). J. Radioanal. Chem.; 21: No. 1, 135-150(1974). (In German).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

Four chromatographic support materials from the production of GDR firms, one polytetrafluoroethylene support from USSR, polytrifluorochlorethylene and Hyflo-Super-Cel were investigated for suitability under conditions of separation of uranium from other constituents of irradiated uranium fuel solutions with tributylphosphate as an extracting agent. Among the supports there is a new material developed in GDR on the basis of polytetrafluoroethylene with some favorable properties. The experimental results are discussed in connection with the problem of comparison criteria for columns with supports differing in chemical nature, particle size and other parameters. Reduced plate height and velocity were used to arrange experiments under comparable conditions. The results indicate the fluorocontaining supports to be the most suitable ones from the investigated materials for the considered separation problem. (auth)

31557 EXTRACTION OF MICROAMOUNTS OF CESIUM INTO DIFFERENT ORGANIC SOLVENTS IN THE PRESENCE OF SODIUM DIPICRYLAMINATE. Benesova-Paciova, M.; Kyrs, M.; Rais, J. (Inst. of Nuclear Research, Rez, Czech.). J. Radioanal. Chem.; 21: No. 1, 107-118(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

A study was made of the extraction of microamounts of cesium from the aqueous phase into 28 organic solvents in the presence of sodium dipicrylaminate and nitrate, and the extraction of macroamounts of cesium and rubidium dipicrylaminates from nitrobenzene and nitromethane into some other organic solvents. The equilibrium constants of the reaction $Cs^+_a + Na^+_o = Cs^+_o + Na^+_a$ were determined and a correlation with the water content of the organic phase is discussed. (auth)

31558 DETERMINATION OF U, Np, AND Pu IN URINE BY SEQUENTIAL EXTRACTION WITH ALAMINE-336 FROM HYDROCHLORIC ACID MEDIUM. Veselsky, J. C.; Pak Chan Kiri; Sezginer, N. (International Atomic Energy Agency Lab., Seibersdorf, Austria). J. Radioanal. Chem.; 21: No. 1, 97-106(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

A method was developed for the extraction of uranium, neptunium, and plutonium from human urine using the comparatively cheap technical amine ALAMINE-336. These elements are coprecipitated with a calcium phosphate carrier, which is then subjected to a wet-ashing procedure with HNO_3/H_2O_2 and HCl/H_2O_2. The residue is dissolved in 10M hydrochloric acid and U, Np and Pu are extracted with a 10% ALAMINE-336/xylene solution, followed by subsequent back-extraction with 10M HCl/NH_4I (Pu), 4M HCl/HF (Np) and 0.1M HCl (U), respectively. The average recoveries are around 95%. (auth)

31559 THERMODYNAMICS OF EXTRACTION EQUILIBRIA. III. The Uranyl Chloride–Hydrochloric Acid–di-2-Ethylhexylphosphoric Acid–Toluene System. Ruvarac, A. L. (Boris Kidric Inst., Belgrade); Maksimovic, Z. B.; Halasi, R. M. J. Radioanal. Chem.; 21: No. 1, 39-45(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

A simple graphical method for determination of thermodynamic equilibrium constants, developed for ion-exchange and solvent extraction processes, was successfully applied to a liquid exchanger system. Close values of the thermodynamic equilibrium constants for the system uranyl chloride–hydrochloric acid–di-2-ethylhexyl phosphoric acid–toluene ($K = 7.8 \pm 0.8$) were obtained when the ionic strength of the aqueous phase was varied and the concentration of di-2-ethylhexyl phosphoric acid in the organic phase was kept constant, and vice versa. (auth)

31560 CYCLOTRIPHOSPHAZOTRIENE COMPLEXING WITH ACTINIDES. Laskorin, B. N.; Filippov, E. A.; Skorovarov, D. I.; Phomenkov, V. G.; Serebryakov, I. S. (Atomic Energy Commission, Moscow). J. Radioanal. Chem.; 21: No. 1, 57-64(1974).

From 7th radiochemical conference; (Marianske Lazne, Czechoslovakia).

The dependence of uranium, plutonium, and americium extraction by substituted cyclotriphosphazotriene is discussed. (auth)

31561 EXTRACTION OF URANIUM AND PLUTONIUM BY TERTIARY ALIPHATIC PHOSPHINE OXIDES. Laskorin, B. N.; Skorovarov, D. I.; Philippov, E. A.; Volodin, I. I. (Atomic Energy Commission, Moscow). J. Radioanal. Chem.; 21: No. 1, 65-79 (1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

The effect of the structure of the alkyl chain in trialkyl phosphine oxides (TAPO) on their extractive ability for uranium(VI) and plutonium(IV) in various diluents was investigated. Solid complex compounds of U(VI) with TAPO were isolated and characterized by the DTA and infrared spectra measurements. (auth)

31562 THERMODYNAMICS OF EXTRACTION OF TETRAVALENT PLUTONIUM, URANIUM, THORIUM, AND ZIRCONIUM. Solovkin, A. S. (Atomic Energy Commission, Moscow). J. Radioanal. Chem.; 21: No. 1, 15-29(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

Thermodynamic treatment of the experimental data on the extraction of quadrivalent Pu, U, Th and Zr with tri-n-butyl phosphate (TBP) from nitric acid solutions is presented. It is shown that the extraction of all the quadrivalent metals studied is going according to the same mechanism: $M(OH)^{4-i}_4 + (4-i)NO^-_3 + 2TBP \rightleftharpoons M(OH)_i(NO_3)_{4-i} \cdot 2\ TBP$. For Zr, $i = 0$, 1, and 2; for the remaining M(IV), $i = 0$ and 1. The thermodynamic constants of extraction of M(IV) with the kerosene solutions of TBP according to the above mentioned equation are as follows: Zr: $K^0_3 = 0.6$; $K^0_2 = 14$; $K^0_1 = 5$. Pu: $K^0_3 = 380$; $K^0_2 = 4.8 \cdot 10^4$. U: $K^0_3 = 300$; $K^0_2 = 1.8 \cdot 10^4$. Th: $K^0_3 \approx 150$. It has been established that Zr and Pu(IV) are extracted into 2-thenoyltrifluoracetone (HA) from perchloric acid solutions under the formation of MA_4 and $M(ClO_4)A_3$ species. For the extraction from nitric acid solutions, the species formed are ZrA_4 and

$Zr(NO_3)A_3$ in the case of Zr, PuA_4 and $Pu(OH)A_3$ in the case of Pu. The differences in the qualitative and quantitative characteristics of the extraction of M(IV) with TBP and HA from nitric and perchloric acids are explained by the effect of the character of the acid and of ionic potential upon the structure of the hydration shell of M^{4+}_{aq}. (auth)

31563 SORPTION OF IODINE BY AV-17 ANION-EXCHANGE RESIN IN VARIOUS SALT FORMS. Ivanov, N. D. (All-Union Scientific-Research and Design Institute of Secondary Nonferrous Metals, Donetsk, USSR). J. Appl. Chem. USSR (Engl. Transl.); 47: No. 3, 490-493(Mar 1974).

Translated from Zh. Prikl. Khim.; 47: No. 3, 487-491(Mar 1974).

The degrees of sorption and desorption of iodine and changes of exchange capacity depend on the affinity of the counter ion of the original resin form, the composition of the adsorbate, and side reactions accompanying sorption. For extraction of elemental iodine from iodine-containing solutions the highly basic anion exchanger AV-17 should be used in chloride form or in ionic forms indifferent with respect to the adsorbate. (auth)

31564 ION EXCHANGE IN DIMETHYL SULFOXIDE MEDIA. IV. Separation of Beryllium from Various Metal Ions in the System DMSO-H_2O-SCN-Dowex 50 W. Janauer, G. E.; Madrid, E. O. (State Univ. of New York, Binghamton). Mikrochim. Acta; No. 5, 769-781(1974).

Selective separations of beryllium from other metal ions (Cu, Cd, Zn, Ni, Fe, Co, Mg, Ca, Sr, Ba, Al, and Pb) were achieved by means of cation exchange in an aqueous 20% v/v DMSO medium containing 0.25 mol/l of thiocyanate. The observed improvements of separation factors in the presence of DMSO were attributed mainly to enhanced complex formation with thiocyanate for a number of heavy metal ions, and for increased differentiation of solvation tendencies in the binary medium. From a semi-quantitative study of species distribution it was concluded that strongly solvated $BeSCN^+$ and Be^{++} species predominate under conditions of the described column elutions, although traces of $Be(SCN)_2$ may be present. The simplicity and convenience of the described procedure suggest wide applicability for isolation or separation of μg to mg amounts of beryllium from concomitant cations, particularly in the presence of large quantities of aluminum and the alkaline-earth metals. (auth)

31565 PRECONCENTRATION OF MANGANESE, COBALT, YTTRIUM, ZIRCONIUM, NIOBIUM, RUTHENIUM, EUROPIUM, AND PROTACTINIUM BY VARIOUS HYDROXIDES. Strohal, P.; Noethig-Hus, D. (Rudjer Boskovic Inst., Zagreb). Mikrochim. Acta; No. 5, 899-907(1974).

The removal of trace elements from dilute water solutions by hydroxide precipitates was investigated. The coprecipitation yields of manganese, cobalt, ruthenium, europium, and protactinium onto beryllium, zinc, iron, lanthanum, and titanium hydroxides were studied in the pH region from 3 to 11, while those of manganese, cobalt, yttrium, zirconium, niobium, ruthenium, europium, and protactinium onto the same hydroxides were investigated in seawater media. The influence of some other factors, such as the presence of neutral electrolyte and NH_4^+ ions, aging of hydroxide precipitates etc. on the coprecipitation yields were also examined. (auth)

31566 BEHAVIOR OF CALCIUM, SCANDIUM, AND IRON(III) CATIONS IN ION EXCHANGE IN CONCENTRATED MINERAL ACIDS. Simek, M. (Inst. for Analytical Chemistry, Brno). Collect. Czech. Chem. Commun.; 39: No. 7, 1693-1699(Jul 1974). (In German).

The distribution coefficients of Ca^{2+}, Sc^{3+}, and Fe^{3+} ions in sorption on a strongly acid cation exchanger were studied in concentrated perchloric, hydrochloric, nitric, and sulfuric acid medium. The relation between the distribution curves of Ca^{2+} and Sc^{3+} and the pattern of the average acid activity coefficients were determined at high concentrations. The increased sorption of Ca^{2+} and Sc^{3+} ions can be explained by their partial dehydration, which leads to stronger interactions between the cation and the $R-SO_3^-$ ion exchange groups during activity decrease of the water in concentrated acid solutions. As the composition of the ion exchange phase showed, the high values of the Fe^{2+} distribution coefficients in concentrated hydrochloric acid remain in correlation with the extraction of the ion pair $H^+FeCl_4^-$ in this phase. (tr-auth)

31567 RAPID DETERMINATION OF HYDROGEN ISOTOPES BY GAS-SOLID CHROMATOGRAPHY. Dericbourg, J. (CNRS, Villers, France). J. Chromatogr.; 94: 325-329(1974). (In French).

The determination of hydrogen isotopes was made in a relatively short, 90 cm, pyrex tube filled with Merck γ acid aluminum dioxide. The dioxide was activated by heating in situ at 150°C for an hour. Hydrogen was used as the carrier gas in order to avoid a parasitic separation of ortho- and para-hydrogen. The chromatograms obtained show three peaks: D_2, HD, and H_2. The quantitative determination of the isotopes can be made using either the heights or areas of the peaks. The determination of the peak areas with an electronic integrator gives precisions of 0.5%. The use of a short column, hydrogen as carrier gas, and an electronic integrator makes it possible to determine hydrogen isotopes in a very short time of 1 min in a simple manner with low-cost. (JSR)

31568 EXTRACTION OF NEODYMIUM AND ERBIUM COMPLEXES WITH 2,3-OXYNAPHTHOIC ACID AND 1,10-PHENANTHRONE. Mishchenko, V. T.; Tselik, E. I.; Poluektov, N. S. Zh. Neorg. Khim.; 19: No. 8, 2028-2032(Aug 1974). (In Russian).

On the basis of a study of the absorption spectra it was established that Nd and Er ions form mixed complexes with 2,3-oxynaphthoic acid (ONA) and 1,10-phenanthrone (phen), extractable with chloroform. The ratio of the components in the complexes is Me^{3+} : ONA : phen = 1 : 3 : 1 at pH 4 to 7.5. In the absence of 1,10-phenanthrone the complex with the ratio of the components Me^{3+} : ONA = 1 : 3 at pH 5.5 to 7.5 is extracted with cyclohexane. (tr-auth)

31569 ION ASSOCIATES OF NEODYMIUM AND ERBIUM WITH BENZILIC ACID AND RHODAMINE C. Mishchenko, V. T.; Lomakina, E. G.; Poluektov, N. S. Zh. Neorg. Khim.; 19: No. 8, 2106-2108(Aug 1974). (In Russian).

It was established that the ions Nd^{3+} and Er^{3+} form with benzilic acid water-insoluble at pH 5 to 7 compounds with the composition $Me(BA)_3$. In the presence of rhodamine C (Rhod) ion associates with the composition $[Me(BA)_4]$. Rhod are formed that can be extracted with benzene in the pH range 5.2 to 8.3 for Nd and 4.3 to 7.5 for Er. (tr-auth)

31570 ANALYTICAL USE OF ALKYLPHOSPHORIC ESTERS. XII. Extraction of Ca^{2+} with Dialkylphosphoric Acids. Upor, E.; Klesch, K. Magy. Kem. Foly.; 80: No. 7, 298-301(Jul 1974). (In Hungarian).

The extraction of Ca with di(n-butyl)phosphoric acid and di(2-ethylhexyl) phosphoric acid was studied. The slope of the relation $\lg[H_2A_2] - \lg D_{Ca^{2+}}$ is equal to +2, but the slope of $\lg[H] - \lg D_{Ca^{2+}}$ is equal to −2. The variation between the literature data is probably connected with the neglect of the change of the equilibrium concentration of the hydrogen ion. It was established that the addition of TBP or C_4H_9OH leads to antagonism. Synergism was not detected. Extraction with the butyl phosphoric acid was successfully applied to the separation of Ca^{2+} from Sr^{2+} and Ba^{2+}. (tr-auth)

31571 SEPARATION OF BISARENE π COMPLEXES OF MOLYBDENUM BY MOLECULAR DISTILLATION. Devyatykh, G. G.; Umilin, V. A.; Tyutyaev, I. N. J. Appl. Chem. USSR (Engl. Transl.); 47: No. 3, 497-500(Mar 1974).

Translated from Zh. Prikl. Khim.; 47: No. 3, 494-498(Mar 1974).

Molecular distillation for separation of bisarene π complexes of molybdenum was conducted under $10^{-3}-10^{-4}$ mm pressure, which corresponds to temperatures of 80-100° for organometallic compounds of molybdenum. The results show that molecular distillation is effective for isolation of organometallic compounds of molybdenum in pure form. (LK)

31572 OXIDATIVE STRIPPING PROCESS FOR THE RECOVERY OF URANIUM FROM WET-PROCESS PHOSPHORIC ACID. Hurst, F. J.; Crouse, D. J. (to United States Atomic Energy Commission). US Patent 3,835,214. 10 Sep 1974. Filed Date 15 Aug 1972. 4p.

A process for the recovery of uranium from a wet-process type phosphoric acid solution is effected by adjusting the solution with sufficient ferrous ion to insure that the uranium is in the uranous form, contacting the adjusted solution with an organic phase consisting essentially of a mono- and disubstituted phenyl ester of orthophosphoric acid dissolved in an inert diluent to effect transfer of the uranium into the organic phase, stripping the uranium from the organic phase with a 6 to 12 M phosphoric acid solution containing an oxidizing agent to produce a uranyl phosphate strip solution more highly concentrated in uranium than the wet-process feed solution. (Official Gazette)

31573 PROCESS FOR SEPARATING NEPTUNIUM FROM THORIUM. Schulz, W. W. (to United States Atomic Energy Commission). US Patent 3,835,044. 10 Sep 1974. Filed Date 16 Oct 1972. 6p.

A process is disclosed for separating neptunium from thorium in aqueous solution which comprises contacting the aqueous solution with a weak-base anion exchange resin whereby the neptunium is preferentially adsorbed on the weak-base anion exchange resin to a greater extent than for the strong-base (quarternary group) resins hitherto used. The process is particularly useful in separating and recovering neptunium from atomic energy plant feed solutions comprising neptunium, uranium, thorium, protactinium, niobium, ruthenium, rhodium and zirconium. The preferred weak-base anion exchange resins are of the macroreticular type such as those disclosed in British Pat. 932,125. (Official Gazette)

31574 SEPARATION OF MICROQUANTITIES OF NIOBIUM FROM OTHER ELEMENTS BY EXTRACTION CHROMATOGRAPHY WITH AMINES. Gibalo, I. M.; Mymrik, N. A. (Moscow State Univ.). pp 206-210 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

The extraction-chromatographic distribution of Nb in a system of high-molecular amine–HCl was studied as a function of the HCl concentration and the amine structure. It was established that the recovery of Nb increases with increase of the HCl concentration and passes through a maximum at 8.5 to 9.5 M HCl. Nb passes into the organic phase of the column in the form of the doubly charged anion $NbOCl_5^{2-}$. It was shown that the sorption of acid complexes of Nb depends on the structure of the amine and increases in order of the increase of its molecular mass. Studies were made on the distribution in analogous conditions of the elements accompanying Nb, and the conditions for the separation of binary and multicomponent mixtures containing Nb, Zr, Ti, Mo, W, and Fe were determined. The method was used for the separation of the radioactive isotopes ^{95}Nb and ^{95}Zr. (tr-auth)

31575 SORPTION OF TITANIUM AND SCANDIUM BY IONITES FROM MIXED SOLVENTS. Belyavskaya, T. A.; Vrykina, G. D. (Moscow State Univ.). pp 217-221 of Uspekhi Analiticheskoi Khimii. Solotov, Yu. A. (Ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

New data were obtained on the sorption of Ti and Sc by the cationite Ku-2x8-N and AV-17x8 in different salt forms from water-organic solutions of oxalic, tartaric, and citric acid. It was shown that the sorption of Ti and Sc by the ionites depends on the nature of the complexing reagents, the organic solvents, and the element. The degree and intensity of the complex formation reaction in solution showed a greater effect on the sorption of the elements in the water-organic medium than in the water. It was found that the sorption behavior of the elements in the aqueous solutions of oxalic, tartaric, and citric acid was almost the same but differed in the presence of organic solvents. This difference can be used as the basis of the chromatographic method for the concentration and separation of Sc and Ti. The organic solvents studied were acetone, ethers, and dimethylformamide. (tr-auth)

Inorganic, Organic, and Physical Chemistry

Refer also to abstracts 32740, 32750, and 34179.

31576 SOLID STATE CHEMISTRY. Rao, C. N. R. (Ed.). New York; Marcel Dekker, Inc. (1974). 928p. $59.50.

A seminar in solid state chemistry was held at the Indian Institute of Technology. The most important topics discussed were incorporated into articles which are compiled in the present volume. The topics discussed are a brief review and introduction to inorganic crystal chemistry, growth of polytypes, topotactic reactions in inorganic oxycompounds, crystal growth methods involving chemical reactions, ionicity and covalence in crystals, comparisons of fluorides, oxides, and sulfides containing divalent transition elements, oxide magnetic materials, use of Moessbauer effect in study of ferrites and garnets, transition metal oxides, lanthanide and actinide oxides, ferroelectric materials, ferroelectricity and NMR in KH_2PO_4 systems, optical properties of polyatomic impurities in alkali halides, thermodynamic measurements on solids, and solid state electrochemistry. Individual abstracts were provided for two of the articles. (JSR)

Chemical and Physicochemical Properties

Refer also to abstracts 31685 and 32797.

31577 (NBS-TN-270-7) SELECTED VALUES OF CHEMICAL THERMODYNAMIC PROPERTIES. Tables for the Lanthanide (Rare Earth) Elements (Elements 62 Through 76 in the Standard Order of Arrangement). Schumm, R. H.; Wagman, D. D.; Bailey, S.; Evans, W. H.; Parker, V. B. (National Bureau of Standards, Washington, D. C. (USA)). Apr 1973. 93p. GPO $1.25.

Tables of values for the standard heats and Gibbs (free) energies of formation, entropies and enthalpies at 298.15°K and heats of formation at 0°K for compounds of the rare-earth elements (the lanthanides; lutetium through lanthanum; elements 62 through 76 in the Standard Order of Arrangement) are presented. These tables are a continuation of the comprehensive revision of NBS Circular 500. (auth)

31578 (RD/B/N-2965) VAPOUR PHASE COMBUSTION OF SODIUM. Newman, R. N. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1964. 23p. Dep. NTIS (US Sales Only) $4.00.

A laminar sodium vapour-air diffusion flame was used to study the vapour phase burning of sodium at atmospheric pressure. Spectral recordings in the visible region indicate that the condensed oxide is produced from the gas phase reactions in times of 1×10^{-4} seconds. Sodium D lines are detected in emission above the continuum which low in the flame shows secondary maxima indicative of chemiluminescent reactions. The existence of the gas phase peroxide molecule Na_2O_2 is postulated. From a thermochemical/kinetic analysis of possible flame mechanisms it is postulated that the smoke is formed initially by the reactions: $Na + O_2 + X \rightarrow NaO_2 + X$, $NaO_2 + Na + X \rightarrow Na_2O_2 + X$, and $Na_2O_2 \rightarrow Na_2O_{2(c)}$. (auth)

31579 ISOTOPIC METHOD OF SPECIFIC SURFACE DETERMINATION OF KAOLIN. Kiwinska, M.; Fortunska, W. H. (Inst. of Glass, Warsaw). Szklo Ceram.; 26: 270-273(1973). (In Polish).

On the basis of surface adsorption phenomenon the isotopic method of the specific surface determination of kaolins has been elaborated. The determinations of surface have been performed in the equilibrium of adsorption state for NaH_2PO_4 solution and by the comparison with standard BET method the correlation coefficient has been calculated. The method is simple and precise. (auth)

31580 SEARCH FOR NEW RADIOPROTECTIVE AGENTS. Part XXIV. Synthesis of Some Sulfenamides, Derived From Phenothiazine. Tulecki, J.; Osinska, Z. (Medical Academy, Poznan, Poland). Ann. Pharm. (Poznan); 10: 9-12(1973).

By coupling phenothiazine with 2-, 3-, 4-nitrophenylosulfenylochlorides, the following sulfenamides, underscribed in the available literature, were obtained: 10(2'-nitrophenylothio)-phenothiazine I, 10(3'-nitrophenylothio)-phenothiazine II, 10(4'-nitrophenylothio)-phenothiazine III. (auth)

31581 LANTHANIDE AND ACTINIDE OXIDES: A CASE STUDY IN SOLID-STATE CHEMISTRY. Eyring, L. (Arizona State Univ., Tempe). pp 565-634 of Solid State Chemistry. Rao, C. N. R. (ed.). New York; Marcel Dekker, Inc. (1974).

The present state of knowledge of several aspects of the solid state chemistry of lanthanide and actinide oxides is reviewed. The structures of the lower, sesqui- and dioxides of these elements are analyzed. The homologous series and nonstoichiometry are considered. Phase relations in these oxides are discussed. The mechanism of phase reactions is analyzed. The electrical, magnetic, and optical properties are reviewed. Methods for the growth of single crystals are outlined. (169 references) (JSR)

31582 FERROELECTRIC MATERIALS. Subbara, E. C. (Indian Inst. of Tech., Kanpur). pp 635-701 of Solid State Chemistry. Rao, C. N. R. (ed.). New York; Marcel Dekker, Inc. (1974).

The characteristics of ferroelectric materials are discussed in terms of the properties of barium titanate. Its crystallography, dielectric properties, ferroelectric domains, and piezoelectric properties are examined. The ferroelectric compounds known up to 1971 are tabulated with their Curie temperature and spontaneous polarization. Some of the important features of some of these compounds are cited to show the similarities and the differences between families of compounds. Ferroelectric materials exhibiting ferroelastic, ferromagnetic, semiconducting, or superconducting properties also are discussed. (96 references) (JSR)

31583 SEARCH FOR NEW RADIOPROTECTIVE AGENTS. Part XXIII. Synthesis of Some Sulfur Derivatives of 5-Nitroindole. Tulecki, J.; Skwarski, D.; Spychala, R. (Medical Academy, Poznan, Poland). Ann. Pharm. (Poznan); 10: 3-7 (1973). (In Polish).

By coupling of 5-nitroindole with 2-, 4-nitro- and 2,4-dinitrophenylosulfenylo-chlorides, the following sulfur derivatives of 5-nitroindole not described in the available literature were ob-

tained: N-(2'-nitrophenylo-thio-5-nitroindole I, N-(4'-nitrophenylo-thio-)5-nitroindole II, N-(2',4'-dinitrophenylo-thio-)5-nitroindole III. The compounds were identified by elementary analysis and IR spectroscopy. (auth)

31584 ATOMIC CONCENTRATION OF HYDROGEN IN HYDRIDES. Yatsimirskii, K. B.; Kriss, E. E.; Davidenko, N. K.; Kucherenko, E. V. (Inst. of Physical Chemistry, Kiev). Ukr. Khim. Zh.; 40: No. 7, 675-682(Jul 1974). (In Russian).

The hydrogen numbers (proportional atomic concentration of hydrogen) were calculated for hydrides of different classes of elements. The dependence of the hydrogen number of the hydride on the position of the element studied in the periodic system, the atomic dimensions of the element, nature of the chemical bond in the hydride, and the capacity of the hydride for formation of the polymer form was shown. (tr-auth)

31585 INVESTIGATION OF THE INTERACTION OF CO_2 WITH CaY ZEOLITE AND CATALYTIC PROPERTIES OF THE CaY–CO_2 SYSTEM IN THE DISPROPORTIONATION OF TOLUENE, USING RADIOCARBON. Minachev, Kh. M.; Isagulyants, G. V.; Isakov, Ya. I.; Usachev, N. Ya.; Rozhdestvenskaya, N. N. (Inst. of Organic Chemistry, Moscow). Bull. Acad. Sci., USSR, Div. Chem. Sci. (Engl. Transl.); 23: No. 1, 35-39(Jan 1974).

Translated from Izv. Akad. Nauk SSSR, Ser. Khim.; 23: No. 1, 42-47(Jan 1974).

Using CO_2 labeled with ^{14}C, it was established that in contact with CaY zeolite under conditions of the disproportionation of toluene, CO_2 is sorbed in two ways: strongly (not removed at 500-700°) and weakly (removed by nitrogen). The promoting action of CO_2 is associated with the weakly sorbed form. Strongly sorbed CO_2 has no appreciable influence on the acid properties and catalytic activity of CaY in the disproportionation of toluene. (tr-auth)

31586 SEARCH FOR NEW RADIOPROTECTIVE AGENTS. Part XXV. Synthesis of Some Sulfides of 2-Quinoxaline Derivatives. Tulecki, J.; Kalinowska-Torz, J.; Powalska, J. (Medical Academy, Poznan, Poland). Ann. Pharm. (Poznan); 10: 13-16 (1973).

By condensation of 2-chloroquinoxaline with β-thionaphtole, β-naphtyloaminoacetylo-mercaptane and p-chlorothiophenol, the following compounds, not described in the available literature, were obtained: 2-(β-naphtylothio)quinoxaline (I), 2-(β-naphtyloaminoacetylothio)quinoxaline (II), 2-(p-chlorophenyolothio)quinoxaline (III). The compounds were identified by elementary analysis and assayed biologically. (auth)

31587 VAPOR PHASE SUBSTITUTION FLUORINATION OF AROMATICS WITH XENON DIFLUORIDE. MacKenzie, D. R.; Fajer, J.; Smol, R. (to United States Atomic Energy Commission). US Patent 3,833,581. 3 Sep 1974. Filed date 23 Jul 1971. 4p.

The process was developed for producing a fluorine-substituted aromatic compound comprising the step of reacting an aromatic compound in the vapor phase with xenon difluoride vapor at a moderate temperature on the order of about 200°C at a mole ratio of xenon difluoride to said aromatic compound of no greater than 1. (Official Gazette)

31588 PROCESS OF THE ELECTROPRECIPITATION OF OXYGEN-CONTAINING SOLID-PHASE COMPOUNDS OF TUNGSTEN. Vas'ko, A. T.; Shaturskaya, V. P.; Semenova, G. S. (Inst. of General and Inorganic Chemistry, Kiev). Ukr. Khim. Zh.; 40: No. 8, 812-816(Aug 1974). (In Russian).

It was established that in the presence of hydrogen peroxide on the cathode high-molecular oxygen-containing compounds of W, growing with time, were obtained. These compounds can be formed as a result of the electrochemical initiation of polymerization processes. (tr-auth)

Isotope Effects

Refer also to abstract 31627.

31589 (BNL-19160) ISOTOPE EFFECTS AND QUANTUM-MECHANICAL TUNNELING. Weston, R. E. Jr. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 22p. (CONF-740428-6). Dep. NTIS $4.25.

From 167th national meeting of the American Chemical Society; Los Angeles, California, USA (1 Apr 1974).

Evidence for tunneling in chemical reactions has been previously investigated by studying differences in the tunneling corrections for reactions involving the motion of H, D, or T atoms or ions. Studies on the temperature dependence of tunneling and its bearing on kinetic isotope effects were expanded. Several model systems were examined including tunneling corrections in the isotope effect. Correlation of the rate constant ratios k_H/k_D and k_H/k_T may be defined as $r = \ln(k_H/k_T)/\ln(k_H/k_D)$. It is concluded that even when quantum-mechanical tunneling is important, the limits $1.33 \leq r \leq 1.58$ are not likely to be exceeded, if they would not be exceeded in the absence of tunneling. There is no general correlation between the magnitude of r and the importance of tunneling. The temperature dependence of r is qualitatively the same for a wide range of barrier heights and reaction models. (JGB)

31590 (COO-3151-40) ISOTOPE SPLITTING OF THE Cl^- GAP MODE IN KI. Report No. 2227. Shotts, W. J.; Sievers, A. J. (Cornell Univ., Ithaca, N.Y. (USA). Lab. of Atomic and Solid State Physics). May 1974. Contract AT(11-1)-3151. 13p. Dep. NTIS $4.00.

High-resolution measurements of the far-infrared lattice gap mode of Cl^- in KI at 1.2°K reveal the presence of three absorption lines at 76.46 ± 0.05, 76.75 ± 0.02 and 77.08 ± 0.02 cm^{-1}. These lines are explained in a model which includes the isotope splitting resulting from both the Cl^- impurity and its K^+ nearest neighbors. In addition, the full linewidth of the 77.08 cm^{-1} line is determined to be 0.06 ± 0.02 cm^{-1} and is ascribed to strain broadening. (auth)

31591 (COO-3498-18) MEAN SQUARE FORCE IN SIMPLE LIQUIDS AND SOLIDS FROM ISOTOPE EFFECT STUDIES. Bigeleisen, J.; Lee, M. W.; Mandel, F. (Rochester Univ., N.Y. (USA). Dept. of Chemistry). 1974. Contract AT(11-1)-3498. 27p. Dep. NTIS $4.50.

The vapor pressure isotope effect in the rare gases, neon, argon, and krypton, was used to determine $\langle\nabla^2 U\rangle$, mean Laplacian of the intermolecular potential, as a function of temperature in the rare gas solids and liquids. An abrupt discontinuity is found at the triple point which is closely correlated with the density change on melting. The mean square force between rare gas atoms in the liquid is linear in ρ, the density, divided by T from the triple point to near the critical temperature. Deviations of the order of ten per percent have been found from the law of corresponding states for $\langle\nabla^2 U\rangle$. It is shown that excellent agreement is obtained between measured values of $\langle\nabla^2 U\rangle$ and radial distribution functions calculated by molecular dynamics and statistical mechanics. (auth)

31592 (ORNL-5001) INFRARED STUDIES OF THE ADSORPTION-DESORPTION OF WATER ON MONOCLINIC AND TETRAGONAL ZrO_2 AS A FUNCTION OF TEMPERATURE. Agron, P. A.; Fuller, E. L.; Holmes, H. F. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 48p. Dep. NTIS $5.45.

The adsorption-desorption cycling studies at elevated temperatures of submonolayer water coverages on the surface of two zirconium oxide polymorphs leads to a partial resolution of the vibrational frequencies due to chemisorbed and physisorbed species. The narrow stretching frequency band, $\nu(O_1\text{-}H)_M$ for the monoclinic phase ZrO_2-G, at 3760 cm^{-1} is assigned to chemisorbed OH groups bound to a single cation at crystal corners and edges. This singly coordinated anion is here designated as a "free" hydroxyl anion. This orientation enables the anion to accept an H-bonding donor water molecule. The polarizing effect of the H-bond lowers the stretch frequency of this hydroxyl anion. The relatively narrow band $\nu(O_2\text{-}H)_M$ at 3660 cm^{-1} is assigned to chemisorbed hydroxyls coordinated to more than a single cation on oxide lattice sites of low index faces. In this instance the oxygen atom of the latter anion is sterically unable to accept an H-bonding donor water molecule. The partially resolved high frequency bands $\nu(O_{1a}\text{-}H)_T$ and $\nu(O_{1b}\text{-}H)_T$ at 3740 and 3720 cm^{-1}, respectively, are attributed to chemically bound "free" hydroxyl groups of the tetragonal oxide, ZrO_2-C, at two non-equivalent oxygen lattice sites. The stretching frequencies of these two species are likewise lowered by H-bonded water. Hydroxyls coordinated to more than one cation, at two different lattice spacings, are assigned to $\nu(O_{2a}\text{-}H)_T$ = 3662 cm^{-1} and $\nu(O_{2b}\text{-}H)_T$ = 3645 cm^{-1}. At 300°C the half width of the "free" hydroxyl is ~70 cm^{-1} and ~95 cm^{-1} for the hydroxyls coordinated to multiple cations. The partially resolved broader bands, of several hundred wave numbers, observed at the lower frequencies on extensive desorption from both polymorphs are attributed to water molecules strongly bound to the oxide surface. The energy and extent of the H-bonded network of water molecules held on the surface or in micropores of these two polymorphic oxides may be judged from the position and intensity of the bending frequency, respectively, for the water molecule. The resolution of the H_2O sub-bands is accomplished by exchange reactions with D_2O. The corresponding ν(O-D) stretch bands are observed. The ratios of the assigned $\nu(O\text{-}H)/\nu(O\text{-}D)$ stretch frequencies show satisfactory agreement with the theoretical ratio. The rapid exchange of isotopic species indicates that the exchange takes place on the solid surfaces. The extent of D_2O exchange is governed by the number of successive adsorption-desorption cycles. (auth)

31593 VINYLIC CATIONS FROM SOLVOLYSIS. XXII. High Stereoselectivity in the Synthesis of and Ion Pair Return in the Solvolysis of (E)-α-Bromo-β-Deuterio-p-Methoxystyrene. Rappoport, Z.; Apeloig, Y. (Hebrew Univ., Jerusalem). J. Amer. Chem. Soc.; 96: No. 20, 6428-6436(2 Oct 1974).

Addition of HBr to α-anisyl-β-deuterioacetylene (7-D) in several solvents of low dielectric constants gives a mixture of (E)- and (Z)-α-bromo-β-deuterio-p-methoxystyrenes (4-E and 4-Z) with little or no preference for the E isomer. More 4-E is formed in chloroform in the presence of Et_4NBr, and the highest selectivity (80% 4-E :20% 4-Z) is obtained in the presence of $HgBr_2$. The selectivity is ascribed to a syn addition of molecular or ion-paired HBr to 7-D, while the nonselective addition takes place via the free vinyl cation 5-D. Solvolysis of a mixture of 4-E and 4-Z in 50% EtOH gives mainly α-deuterio-p-methoxyacetophenone (10-D) and shows no 4-E ⇌ 4-Z isomerization. In AcOH, p-methoxyacetophenone (10-H) is formed exclusively, Et_4NBr enhances the solvolysis rate, a 4-E ⇌ 4-Z isomerization takes place during the solvolysis, the isotope effect k(4-H) k(60% 4-E + 40% 4-Z) is 1.21, and exchange of the vinylic deuterium with the solvent was not observed. It is suggested that the solvolysis proceeds via an ion pair which only gives products in 50% EtOH, while in AcOH 63% of the ion pairs give ion pair return to 4-E and 4-Z and 37% give 10-H. The ion pair return in α-anisylvinyl bromides decreases on decreasing the bulk of the β substituents in aqueous EtOH, but the return in AcOH is insensitive to this factor. This is discussed in terms of capture and dissociation of the ion pairs. (auth)

31594 DETECTION OF HYDROGEN–DEUTERIUM EXCHANGE IN PURINES BY LASER-RAMAN SPECTROSCOPY. Adenosine 5′-Monophosphate and Polyriboadenylic Acid. Livramento, J.; Thomas, G. J. Jr. (Southeastern Massachusetts Univ., North Dartmouth). J. Amer. Chem. Soc.; 96: No. 20, 6529-6531(2 Oct 1974).

The effect of deuterium exchange of the 8-CH group on the laser Raman scattering spectra of adenosine 5′-monophosphate (5′-rAMP) and polyriboadenylic acid (poly(rA)) was reported. It is shown that the Raman spectra provides a far simpler method than tritium labeling for determination of the rate constant in purine nucleotides. (JSR)

31595 E2C MECHANISM IN ELIMINATION REACTIONS. VII. Secondary Kinetic Hydrogen Isotope Effects in E2 Reactions of Alicyclics. Cook, D.; Hutchinson, R. E. J.; Parker, A. J. (Australian National Univ., Canberra). J. Org. Chem.; 39: No. 20, 3029-3038(4 Oct 1974).

Secondary kinetic hydrogen isotope effects on the rates of some base-induced dehydrotosylations and dehydrobrominations of cyclohexyl derivatives (E2C-like reactions) have been studied. Secondary hydrogen isotope effects at C_α(13-15%) and at C_β(15-25%) indicate that significant hybridization changes occur at both C_α and C_β in reactions leading to E2C-like transition states. Secondary hydrogen isotope effects (11-22%) at C_ζ (adjacent to C_α and allylic to the site of double-bond development) arise most probably from hyperconjugative interactions and suggest either a well-developed double bond between C_α and C_β, or a well-developed positive charge at C_α in E2C-like transition states. The observed secondary hydrogen isotope effects are not consistent with those paene-carbonium E2 transition states in which there is very little change in hybridization taking place at C_β. For the SN2 reactions which accompany E2C-like reactions, secondary β-hydrogen isotope effects are of the same order of magnitude as those for the elimination reactions, whereas, in contrast, it appears that secondary α-hydrogen isotope effects are much smaller for SN2 reactions than they are for E2C-like reactions. The nature of the transition states for E2C-like reactions and their concomitant SN2 reactions are discussed in the light of these findings. (auth)

31596 IR SPECTRA AND STRUCTURE OF SOME PENICILLIN DERIVATIVES. IV. Debecillin. Dziegielewski, J.; Hanuza, J.; Jezowska-Trzebiatowska, B. (Univ., Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci. Chim.; 22: No. 6, 505-517(Jul 1974).

Infrared spectra (200 to 4000 cm^{-1}) of the normal and deuterated benzathine-salt of benzyl-penicillin were measured in solid state. The interpretation of spectroscopic data and assignment of the bands were made on the basis of the frequency shift by deuteration and on information from the previous studies on penicillin-like antibiotics as well as by using the comparative spectra of ethylenediamine and normal or deuterated dibenzylethylenediamine acetate. (auth)

31597 ISOTOPE EFFECTS OF URANIUM BY ION EXCHANGE IN THE SYSTEM DOWEX 50/α-HYDROXYISOBUTYRATE. Aaltonen, J.; Pietila, P. (Helsinki Univ. (Finland). Dept. of Radiochemistry); Heumann, K. G. (Technische Univ. Darmstadt (F.R. Germany). Fachbereich Anorganische Chemie und Kernchemie). Z. Naturforsch., b; 29: No. 3/4, 190-194(Apr 1974).

3 figs.; 2 tabs.; 18 refs.

The isotope effect of uranium in the system Dowex 50 resin/α-hydroxyisobutyrate solution was studied by mass spectrometry. A recycle ion exchange column was used for the separation experiments. The dependence of the isotope effect on the pH value and on the concentration of the α-hydroxyisobutyrate solution used as eluent was investigated and the elementary separation factor of uranium was calculated to be 1.00019 and 1.00006. An enrichment of ^{235}U in relation to ^{238}U was found in the solution. In addition, the distribution factor of the uranyl ions in the investigated system was determined in the pH range between 2 and 6. (GE)

31598 ISOTOPE SHIFT MEASUREMENTS IN THE ATOMIC SPECTRUM OF LANTHANUM (LaI). Fischer, W.; Huehnermann, H.; Mandrek, K. (Marburg Univ. (F.R. Germany). Fachbereich Physik). Z. Phys.; 269: No. 3, 245-252(1974).

3 figs.; 4 tabs.; 38 refs. Partly reported at the Fruehjahrstagung der DPG, Muenchen 1973.

Using reactor-produced $^{139}_{57}La$, the highly enriched rare $^{138}_{57}La$ and the stable $^{139}_{57}La$, the isotope shift was measured in five lines of the La(I) spectrum with the aid of a pressure-scanned Fabry–Perot interferometer. The isotope shift data obtained show surprisingly large specific mass effects, arising from configuration mixing of levels with a 4f electron involved. The changes $\langle r^2 \rangle$ of these nuclei extracted from the experimental isotope shift constants C_{exp} are compared with the corresponding values for the isotonic barium nuclei, where similar anomalies in the isotope shifts occur. (auth)

31599 TORSIONAL OSCILLATION OF OH AND OD GROUPS IN THE IR SPECTRA OF COMPLEXES OF CARBOXYLIC ACIDS. Glazunov, V. P.; Mashkovskii, A. A.; Odinokov, S. E. Zh. Prikl. Spektrosk.; 21: No. 1, 121-126(Jul 1974). (In Russian).

The absorption bands of the torsional γ(OH) and γ(OD) oscillation of a large number of N-complexes of carboxylic acids and their deuterated analogs were studied by ir spectroscopy. The frequencies and integral intensities of the torsional oscillations were measured. The results obtained indicated that the relation $\Delta\gamma^2 = 6.5 \times 10^4 \Delta H$ is equal for N-complexes of hydrogen halides, phenol, n-butanol, ε-caprolactam and remains valid for a large series of carboxylic acids (4 to 12 kcal/mol). A linear dependence was found between $\Delta\gamma^2$ and $\sqrt{\Delta\nu}$ for the series of N-complexes studied. The isotopic ratio for a series of N-complexes of carboxylic acids was measured and it was shown that for torsional oscillations it remains practically constant for different N-complexes and does not depend on the strength of the hydrogen bond. (tr-auth)

31600 NbO MOLECULE: ESR AND OPTICAL SPECTRA IN INERT MATRICES AT 4°K; ESTABLISHMENT OF ITS GROUND ELECTRONIC STATE AS $^4\Sigma^-$. Brom, J. M. Jr.; Durham, C. H. Jr.; Weltner, W. Jr. (Univ. of Florida, Gainesville). J. Chem. Phys.; 61: No. 3, 970-981(1 Aug 1974).

NbO molecules, produced by the vaporization of a mixture of Nb metal and solid Nb_2O_5 or by passing O_2 gas over hot Nb metal, were trapped in solid Ne or Ar at 4°K and investigated by ESR and optical spectroscopy. Analysis of the ESR spectrum established that the molecule has a $^4\Sigma^-$ ground state (as derived from a $\sigma\delta^2$ configuration) exhibiting large hyperfine (hf) splittings from interaction with the ^{93}Nb (I = 9/2) nucleus. Essentially all lines were accounted for as effectively $\Delta M_I = 0$, ±1, and ±2 transitions (or as multiple trapping sites). Hyperfine and g tensor elements have the following values in a neon matrix: $g_\parallel = 2.0023(10)$, $g_\perp = 1.9577(10)$, $|A_\parallel(^{93}Nb)| = 1587(1)$ MHz, and $|A_\perp(^{93}Nb)| = 1647(1)$ MHz. The magnetic parameter $b \cong 0.19$ cm^{-1} found in the gas phase optical spectrum is here determined to be $b = 0.165(1)$ cm^{-1}. These magnetic parameters are in accord with the expected electronic properties of NbO (assuming the A values are positive) and are compared with those of VO. Both $Nb^{16}O$ and $Nb^{18}O$ have been investigated by optical spectroscopy, and the spectra correlate well with gas phase data. The $^4\Sigma^- \leftarrow X\ ^4\Sigma^-$ blue system appears at 461.4 nm in a Ne matrix and contains several vibrational perturbations. At least five systems of bands appear between 530 and 740 nm. It is conjectured that the progression with (0,0) at 655.3 nm is a $^4\Sigma \leftarrow X\ ^4\Sigma$ transition and that the remaining bands arise from a $^4\Pi \leftarrow X\ ^4\Sigma$ system where the upper state is partially Hund's case (c) coupling. In the infrared the vibrational transition of NbO appears as a triplet at 965.5, 973.0, and 977.1 cm^{-1} in neon; a similar triplet was recently observed in argon by Green, Korfmacher, and Gruen. (auth)

31601 EXTRACTION OF HCl BY TDPO IN BENZENE. Mrnka, M.; Jedinakova, V.; Sladkovska, J. (Inst. of Chemical Tech., Prague). J. Radioanal. Chem.; 21: No. 1. 87-95(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

Results of the extraction of HCl by TDPO in benzene and the co-extraction of water are discussed. From the infrared spectra of normal ($HCl-H_2O$) and deuterated ($DCl-D_2O$) systems it may be concluded that TDPO · HCl · H_2O is formed in the organic phase on extraction from aqueous solutions with $c_{HCl} < 5M$, and TDPO · HCl with $c_{HCl} > 5M$. Compounds such as TDPO · 2HCl are found in the organic phase if there is an excess of HCl in the organic phase. From cryoscopic and viscosity measurements of the organic phase, conclusions can be made about the presence of polymeric compounds in this phase. (auth)

31602 UNIMOLECULAR REACTIONS AND ENERGY PARTITIONING. Three- and Four-Centered Elimination Reactions of Chemically Activated 1,1,2-Trichloroethane-d_0, -d_1, and -d_2. Kim, K. C.; Setser, D. W. (Kansas State Univ., Manhattan). J. Phys. Chem.; 78: No. 21, 2166-2179(10 Oct 1974).

The unimolecular three- and four-centered hydrogen chloride elimination reactions of chemically activated 1,1,2-trichloroethane-1-d, formed by the combination of CH_2Cl and $CDCl_2$ radicals, were studied. Two other isomers, 1,1,2-trichloroethane-d_0 and -2,2-d_2, also were studied to confirm reaction mechanisms and to establish intermolecular isotope effects. Partitioning of vibrational energy to the dichlorolefin was characterized by observing the cis–trans unimolecular isomerization rate of 1,2-dichloroethane. Approximately 81% of the total available energy was retained as internal energy of the olefin from the $\alpha\alpha$ process; both the average energy and the energy distribution are consistent with statistical partitioning of the excess energy. The results are less definitive for the $\beta\alpha$ elimination reaction, but substantially less of the available energy was released to the olefin. The energy release data are consistent with the different potential energy changes for the two channels. Fitting the magnitude of the various experimental rate constants to RRKM calculations using optimized four- and three-centered transition-state models gave E_0 values of 59, 57, and 60 kcal mol^{-1} for the $\beta\alpha$, $\alpha\beta$, and $\alpha\alpha$ processes, respectively, of the d_0 isomer. In addition to trichloroethane, chemically activated 1,2-dichloroethane and 1,1,2,2-tetrachloroethane also were generated and the half-quenching pressures were as follows: 1,1,2-trichloroethane-d_0, -d_1, and -d_2, 17, 11, and 8.0 Torr, respectively; 1,2-dichloroethane, 18 Torr; 1,1,2,2-tetrachloroethane, 10 Torr. (auth)

Isotope Exchange and Isotope Separation

Refer also to abstracts 31661 and 32606.

31603 (AED-CONF-73-223-015) CONTINUOUS DEUTERIUM EXCHANGE DEVICE. Pecak, V. 1973. 1p. (In German). (CONF-730698-10).

From European meeting on chemical engineering and ACHEMA congress; Frankfurt am Main, F. R. Germany (20 Jun 1973).

31604 (JEN-288(Pt.1)) HETEROGENEOUS ISOTOPIC AND NONISOTOPIC ION EXCHANGE ON THE SURFACE OF BARIUM SULFATE. Part I. Preparation of the Inorganic Exchanger. Allam, S.; Barrachina, M.; Aparicio, E. (Junta de Energia Nuclear, Madrid (Spain)). 1974. 54p. Dep. NTIS (US Sales Only) $5.75.

The optimum conditions for the preparation of barium sulfate in a suitable granular form for its use as an inorganic ion exchanger are discussed. The specific surface areas of the solids prepared by different methods are determined by the BET method. The equivalent surface area per Ba^{2+} ion, calculated from the isotopic ion exchange reaction in the system $BaSO_4(s)/Ba^{2+}(aq)$, is in good agreement with its theoretical value. For barium sulfate sintered at temperatures between 500 and 1000°C, the number of exchangeable sites on the solid surface, as well as the exchange rate, decreases with sintering temperature and grain size. (auth)

31605 (JEN-289(Pt.2)) HETEROGENEOUS ISOTOPIC AND NONISOTOPIC ION EXCHANGE ON THE SURFACE OF BARIUM SULFATE. Part II. Kinetics and Application. Allam, S.; Barrachina, M. (Junta de Energia Nuclear, Madrid (Spain)). 1974. 64p. Dep. NTIS (US Sales Only) $6.25.

The mechanism of the isotopic and non-isotopic ion exchange of Cs^+, Ba^{2+}, Sr^{2+}, Y^{3+} and Ce^{4+} cations in the presence of solid $BaSO_4$ is discussed. The number of exchangeable Ba^{2+} ions on the surface of sintered and unprocessed $BaSO_4$ increases with temperature up to 70°C. In the non-isotopic exchange reactions carried with both types of solid, the presence of H^+ or Na^+ ions in the liquid phase usually inhibits the solid affinity for the different cations. While the Ce^{3+} ions rapidly exchange with both types of solid, the Y^{3+} ions are only captured by the sintered $BaSO_4$. The ion exchange behavior of the monovalent, bivalent and trivalent cations on the sintered $BaSO_4$ is sufficiently different in aqueous and acid solutions to allow simple group separation. (auth)

31606 ISOTOPIC EXCHANGE OF OXYGEN ADSORBED ON SILVER WITH GASEOUS OXYGEN IN THE CASE OF PROMOTION BY SELENIUM. Kayumov, R. P.; Kal'kova, N. V.; Temkin, M. I. (Physico-Chemical Inst., Moscow). Kinet. Catal. (USSR)(Engl. Transl.); 15: No. 1, 133-140(1974).

Translated from Kinet. Katal.; 15: No. 1, 157-165(1974).

The activation energy of the heteroexchange of oxygen on silver in the case of introduction of selenium on the surface decreases from 35 kcal/mole for pure silver to 18 kcal/mole when 28% of the surface is coated with selenium. In addition, the rate of heteroexchange decreases with increasing coverage with selenium. The indicated results, as well as the ratio of the rates of heteroexchange and homomolecular exchange of oxygen on silver, are explained on the basis of the assumption that exchange is due to processes of adsorption and desorption, leading to a mutual conversion of the surface oxides with the composition Ag_2O and Ag_2O_3. Selenium reduces the strength of the bond of oxygen in the surface oxide Ag_2O_3, which causes an increase in the activation energy of adsorption and a decrease in the heat of adsorption. (auth)

31607 SOME THEORETICAL ASPECTS OF THE USE OF ISOTOPIC EXCHANGE IN A HETEROGENEOUS LIQUID SYSTEM FOR RADIOCHEMICAL SEPARATIONS. Palagyi, S. (Safarik Univ., Kosice, Czech.). J. Radioanal. Chem.; 21: No. 1, 47-55(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1974).

Theoretical possibilities of the application of isotopic exchange in a heterogeneous liquid system to the separation of radionuclides were investigated. With certain simplifying assumptions, equations were derived that enable the calculation of both the separation efficiency and volume concentration for a one-stage separation process under static or dynamic conditions. The relations obtained can be used in the choice of an appropriate method for the separation and simultaneous enrichment of trace amounts of radionuclides from large-volume liquid samples by equilibrium isotopic exchange. (auth)

31608 EFFECT OF SUBSTITUENTS ON THE RATE OF PROTOPHILIC HYDROGEN ISOTOPE EXCHANGE BY COBALTICINIUM SALTS. Bykov, W. C.; Mukhina, T. A.; Setkina, V. N.; Kursanov, D. N. (Inst. of Hetero-Organic Compounds, Moscow). Dokl. Chem.; 214: No. 1-3, 33-35(Jan 1974).

Translated from Dokl. Akad. Nauk SSSR; 214: No. 2, 329-331 (Jan 1974).

Data on the effect of methyl and carboxylate groups on the rate of hydrogen isotope exchange by cobalticinium salts in basic media are reported. The data show that the introduction of electron-donor substituents has a substantial effect on the rate of hydrogen exchange by cobalticinium salts in basic media. The introduction of a methyl group into the cyclopentadienyl ring rendered the ring hydrogens incapable of exchange under the conditions studied. The introduction of a carboxylate group into each ring showed hydrogen exchange by approximately a factor of 20. (LK)

31609 ISOTOPIC EXCHANGE REACTION OF ETHYLBENZENE WITH DEUTERIUM OXIDE. Niwa, M.; Murakami, Y. (Nagoya Univ., Japan). Chem. Lett. (Tokyo); No. 1, 39-42(Jan 1974).

It is shown by means of the isotopic exchange reaction that the reaction intermediate in the oxidative dehydrogenation of ethylbenzene is not desorbed from the catalyst surface. (auth)

Feed Materials Processing

Refer also to abstracts 31572 and 32275.

31610 PREPARATION OF NUCLEAR AND NON-NUCLEAR MATERIAL BY THE SOL–GEL METHOD. Baran, V. (Inst. of Nuclear Research, Rez, Czech.). Nukleon; No. 1, 10-13(1973). (In Czech).

Characteristic features of sol-gel methods and their products are listed. Also discussed are the possible applications of sol-gel products in nuclear chemistry, nonnuclear application of uranium, this mainly depleted, and the application of non-nuclear sol-gel products. Current efforts in the field of sol-gel at the Institute of Nuclear Research, Řež are reviewed. (auth)

Radiation Chemistry

Refer also to abstracts 31662, 31703, 32350, 32376, 32844, 32873, 32874, and 33049.

31611 (AEC-tr-7422/4) NUKLEONIKA. Translation of Nukleonika; 18: No. 4, 159-194(1973). 36p. (TT-73-54035/4). Dep. NTIS $4.00.

31612 (AEC-tr-7422/5) NUKLEONIKA. Translation of Nukleonika; 18: No. 5, 195-238(1973). 42p. (TT-73-54035/5). Dep. NTIS $5.25.

31613 (AEC-tr-7422/6) NUKLEONIKA. Translation of Nukleonika; 18: No. 6, 239-276(1973). 34p. (TT-73-54035/6). Dep. NTIS $4.00.

31614 (COM-74-10899) INDEX AND CUMULATIVE LIST OF PAPERS ON RADIATION CHEMISTRY. Volume VI, Numbers 27-52, July-December 1973. (Notre Dame Univ., Ind. (USA)). Jan 1974. 356p. NTIS $6.00.

The radiation chemistry data center, as part of its operations, collects, keywords, and stores literature of fundamental radiation chemistry and several related fields. This index cumulation of the weekly list of papers on radiation chemistry is intended as a guide to the recent literature and as a searching tool for those who find a printed index valuable. Categories include: radiation chemistry; pulse radiolysis; polymers; molecular radiobiology; hot atom chemistry; ESR; luminescence; photochemistry; theoretical; miscellaneous. Two indexes are provided: one by author's name and the other by keyword. (GRA)

31615 (COM-74-50310/3) RADIATION CHEMISTRY OF ETHANOL: A REVIEW OF DATA ON YIELDS, REACTION RATE PARAMETERS, AND SPECTRAL PROPERTIES OF TRANSIENTS. Freeman, G. R. (Alberta Univ., Edmonton (Canada). Dept. of Chemistry). Feb 1974. 42p. (NSRDS-NBS-48). GPO $0.80.

The yields (G) for products and intermediates formed by irradiation of ethanol, in the solid, liquid and gaseous state, have been compiled and reviewed. Rates of reactions of transient ions and, radicals and spectroscopic parameters, including optical and ESR spectra, are also included. (auth)

31616 (CONF-721001-, pp 116-124) EARLY CHEMICAL EVENTS. Platzman, R. L. (Univ. of Chicago). 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

The mechanisms involved in the physical-chemical stage of interactions resulting from radiation are described. The formation of chemical species, such as radicals and hydrated electrons, the role of negative ions, and the timing of the production of these species are described. The possibility of calculating the initial g values of the chemical species from a knowledge of the cross sections and generalized oscillator strengths obtained earlier is discussed. A description of the possible role of special processes, such as the production of Auger electrons, and the effect on biomolecules of the nonadiabatic appearance of an electron is given. (auth)

31617 (CONF-721001-, pp 131-151) ENERGY- AND CHARGE-TRANSFER PROCESSES IN ORGANIC CRYSTALS. Pope, M. (New York Univ., NY). 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

Experiments dealing with exciton and carrier dynamics in such aromatic hydrocarbon crystals as anthracene and tetracene are summarized. The importance of the triplet exciton as a tracer is emphasized. The triplet exciton can react with other triplet excitons, free radicals, paramagnetic molecules, and charge carriers. The reactions can be followed by an external magnetic field of about 4000 gauss, and both qualitative and quantitative conclusions can be drawn about processes that occur inside tracks generated by high-energy particles in the crystals. The sensitization of hydrophobic molecules and crystals to ionization by the presence of an aqueous environment is discussed. The ability of anisotropic crystals and polymeric molecules to produce confined regions for exciton migration and the importance of these processes in increasing the cross section for capture of this energy is described. (auth)

31618 (CONF-740655-, pp P3p1-5) APPLIED RADIATION CHEMISTRY IN SOUTH AFRICA. Du Plessis, T. A. (Atomic Energy Board, Pelindaba, South Africa). 1974.

From conference on nuclear technology; Cape Town, South Africa (Jun 1974).

A review is given of the relatively new field of radiation technology in South Africa. Attention is drawn particularly to the role which ionizing radiation can play in the spheres of medicine, pharmacology and agriculture. The possibilities inherent in this technology, with the synthesis of chemicals and new synthetic materials, are dealt with briefly, and the reader in invited to consider the promising results already achieved in the manufacture of wood-plastics. Finally, developments with regard to the design and manufacture of large radiation sources in South Africa are briefly sketched. (auth)

31619 (JAERI-M-5542) RADIATION-INDUCED POLYMERIZATION OF ETHYLENE WITH THE PILOT PLANT PICW. 2. Watanabe, H.; Nakajima, H.; Yagi, T.; Watanabe, T.; Suwa, T. (Japan Atomic Energy Research Inst., Tokyo). Feb 1974. 95p. (In Japanese). NTIS (US Sales Only).

Research and development have been carried out since December 1969 on the radiation polymerization of ethylene in aqueous solution of tert-butyl alcohol with the pilot plant PICW of a central source wet-wall type reactor of 50 liter. Forty-four experimental runs were made at pressures of 105-400 kg/cm^2, temperatures 30-80°C, mean dose rates 4×10^4 to 1.9×10^5 and ethylene mole fractions in the reaction zone 0.34-0.77. Several to several tens kilograms of powder polyethylene were produced in each run. The space time yield of polymer was 4.7-16.8 g/l.hr and the molecular weight of polymer could be controlled in 1.3×10^4 to 8.9×10^4. The prevention of polymer from its deposition onto the reactor wall was achieved by circulating the liquid, mostly water, on the reactor wall. Feasibility of the extended-period operation was confirmed. High-energy utilization efficiency was attained by locating the radiation source in the middle of reactor. The radiation process to produce powder polyethylene at temperatures below the melting point has been thus achieved. (auth)

31620 INVESTIGATIONS ON SOME INORGANIC ION-EXCHANGERS AFTER IRRADIATION. Szirtes, L.; Zsinka, L. (Inst. of Isotopes, Budapest). J. Radioanal. Chem.; 21: No. 1, 267-271(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

The changes in the ion exchange properties of crystalline zirconium phosphate, cerium phosphate, and cerium arsenate after irradiation were investigated. The absorbed gamma dose was 10^9 rad in all cases; the experiments were carried out before and immediately after irradiation with the same samples. Besides the investigations of structural change, the ion exchange behavior of the above mentioned materials was studied in detail. The ion exchange capacities were determined using a tracer technique for the alkali metal ions, and some relations between ion exchange and structure were revealed. (auth)

31621 POLYMERIZATION OF MONOMOLECULAR LAYERS ADSORBED ON MONTMORILLONITE: CYCLIZATION IN POLYACRYLONITRILE AND POLYMETHACRYLONITRILE. Blumstein, R.; Blumstein, A.; Parikh, K. K. (Lowell Technological Inst., MA). Appl. Polym. Symp.; No. 25, 81-88(1974).

Acrylonitrile (AN) and methacrylonitrile (MAN) were inserted on the internal surface of sodium and calcium montmorillonites by vapor-phase adsorption at room temperature. The monomer-montmorillonite complexes, of nearly monolayer coverage, were polymerized through free radical initiation with γ rays to give insertion polymer-montmorillonite complexes. Reference PMAN's and PAN's were prepared in bulk and in solution, also with γ initiation. Infrared spectra were taken for the AN-montmorillonite, MAN-montmorillonite, insertion PMAN-montmorillonite, insertion PAN-montmorillonite complexes, and for the reference and insertion PMANs and PANs. The insertion polymers were found to be extensively cyclized, as evidenced by the drastic decrease in the intensity of the IR absorption band of the nitrile at 2220 cm^{-1} and the appearance of bands attributed to the cyclic structure containing $-C = N-$ linkages. The monomer molecules lie flat on the surface of montmorillonite, as evidenced by x-ray diffraction, and they are complexed through ion-dipole interactions with the exchangeable ions (Na^+ or Ca^{++}). This organization of the monomer molecules appears to favor cyclization, which was not observed in the reference polymers. The extent of cyclization depends on the conditions of preparation and has been semiquantitatively determined with ir spectroscopy. (auth)

31622 RADIATION PHENOMENA IN LANTHANUM NIOBATE ($LaNbO_4$) CRYSTALS ACTIVATED BY TRIVALENT HOLMIUM IONS (Ho^{3+}). Vakhidov, Sh. A.; Morozov, A. M.; Nurullaev, E. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 3, 96-98(1974). (In Russian).

This study presents results of investigating photoluminescence, radioluminescence, and thermoemission in γ- and uv-irradiated crystals of $LaNbO_4-Ho^{3+}$ at room temperature and at the temperature and at the temperature of liquid nitrogen (77°K). The character of the thermoemission depends mainly on the presence and type of activator. Emission in the region of 430 nm appeared in all the crystals under study, and can be associated with an un-

NOTICE

A title page for Volume 30, Numbers 7–12, is included at the back of this issue for use in binding those issues.

CORRECTIONS

NSA Vol. 21-28, Report Number Index, page 14, AAEW-R-788 should be: AEEW-R-788.

NSA Vol. 21-28, Report Number Index, page 392, DOCKET-50327-7 should be: DOCKET-50327-74.

NSA Vol. 23, No. 23, Abst. 49505, line 1 should read: (DOCKET-50327-74) SEQUOYAH NUCLEAR PLANT,

NSA Vol. 28, No. 3, Abst. 7435, line 1 should read: (AEEW-R-788) JOSHUA III: THREE-DIMENSIONAL

NSA Vol. 29, No. 1, Abst. 1090, line 5 should read: TIC $4.00 AT.

NSA Vol. 29, No. 2, Abst. 2583, line 5 should read: AT(45-1)-2170. 134p. TIC $5.45 AT.

NSA Vol. 29, No. 2, Abst. 3051, line 4 should read: W-7405-eng-26. 65p. TIC $5.45 AT.

NSA Vol. 29, No. 2, Abst. 4503, line 5 should read: 2170. 44p. TIC $5.45 AT.

NSA Vol. 29, No. 2, Abst. 4518, line 4 should read: 45p. TIC $4.00 AT.

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NSA Vol. 30, No. 4, Abst. 12036, line 4 should read: Amherst (USA)). 31 Jul 1973. 72p. (NSF-RANN-73-056).

NSA Vol. 30, No. 6, Abst. 15383, line 5 should read: NTIS. Line 6 should read: Also available from International Scholarly Book Service, Inc. $32.00.

Volume 30, Number 12, December 31, 1974

NUCLEAR SCIENCE ABSTRACTS

A semimonthly publication of the USAEC Office of Information Services
Published by the USAEC Technical Information Center

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Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

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REACTOR PROTECTION SYSTEMS
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Public availability of all U. S. Atomic Energy Commission reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

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TABLE OF CONTENTS

Volume 30, Number 12, December 31, 1974

Category	Page
CHEMISTRY	3167
Analytical and Separations Chemistry	3167
Activation and Nuclear Reaction Procedures	3167
Chemical and Spectral Procedures	3171
Radiometric and Radiochemical Procedures	3173
Separation Procedures	3175
Inorganic, Organic, and Physical Chemistry	3178
Chemical and Physicochemical Properties	3178
Isotope Effects	3179
Isotope Exchange and Isotope Separation	3181
Feed Materials Processing	3181
Radiation Chemistry	3181
Radiochemistry and Nuclear Chemistry	3186
Hot-Atom Chemistry	3186
Properties of Radioactive Materials	3187
Radioactive Waste Treatment	3189
Radioisotope Production	3191
Reactor Fuel Reprocessing	3192
CONTROLLED THERMONUCLEAR RESEARCH	3194
Confinement and Heating	3194
Diagnostics	3195
Kinetics (General)	3196
Kinetics (Experimental)	3196
Kinetics (Theoretical)	3196
Production	3198
Stability	3199
Thermonuclear Engineering and Equipment	3200
Wave Phenomena	3209
ENGINEERING	3211
Energy Conversion	3211
Facilities and Equipment	3211
Heat Transfer and Fluid Flow	3216
Materials Testing	3217
Nuclear Explosions	3218
Protective Structures and Equipment	3219
Safety Engineering	3220
Vacuum Engineering	3220
ENVIRONMENTAL AND EARTH SCIENCES	3221
Minerals and Ores	3221
Radioactive Effluents	3222
Radioactivity Monitoring and Transport	3224
Atmosphere	3225
Soil	3230
Water	3231
Ecosystems and Food Cycles	3232
Radiometric Techniques	3234
Site Surveys	3236
Thermal Effluents	3237
Chemical Effluents	3245
INSTRUMENTATION	3248
Radiation Detection Instruments	3248
General Detectors and Monitors	3248
Radiation Dosimeters	3250

Category	Page
INSTRUMENTATION (Cont'd.)	
Nuclear Spectroscopic Instrumentation	3253
High Energy Physics Instrumentation	3253
Radiometric Instruments	3254
Radiation Effects on Instrument Components, Instruments, or Electronic Systems	3255
Miscellaneous Instruments	3256
ISOTOPE AND RADIATION SOURCE TECHNOLOGY	3259
Isotope Separation (Industrial)	3259
Isotopic Power Sources	3263
Radiation Sources	3263
Design and Fabrication	3263
Industrial Uses	3264
LIFE SCIENCES	3265
Radiation Effects on Biochemicals	3265
Radiation Effects on Cells	3267
Radiation Effects on Microorganisms	3269
Radiation Effects on Plants	3272
Radiation Effects on Animals	3273
Man	3273
Vertebrates	3278
Invertebrates	3286
Radionuclide Effects (Internal Source)	3288
Man	3288
Animals	3289
Nuclide Kinetics and Toxicology	3290
Man	3290
Animals	3291
Microorganisms	3293
New Tracer Techniques	3293
MATERIALS	3300
Ceramics and Cermets	3300
Metals and Alloys	3306
Corrosion and Erosion	3306
Preparation and Fabrication	3308
Properties, Structure, and Phase Studies	3308
Radiation Effects	3317
Other Materials	3320
NUCLEAR MATERIALS AND WASTE MANAGEMENT	3327
Accountability and Safeguards	3327
Disposal and Storage	3328
Handling Equipment and Procedures	3329
Transportation	3330
PARTICLE ACCELERATORS	3341
Design, Development, and Operation	3341
Auxiliaries and Components	3343
Ion Sources and Injection and Extraction Systems	3344
Ion Optics and Field Calculations	3344
Storage Rings	3345
Experimental Facilities	3346

TABLE OF CONTENTS (continued)

Category	Page
PHYSICS (ASTROPHYSICS AND COSMOLOGY)	3349
Cosmic Radiation	3349
Stars	3352
Quasi-Stellar, Radio, and X-Ray Sources	3359
Solar Phenomena	3360
Galaxies	3364
Cosmology	3371
Planetary Phenomena	3372
PHYSICS (ATMOSPHERIC)	3373
Auroral and Ionospheric Phenomena	3373
Magnetospheric Phenomena	3377
PHYSICS (ATOMIC AND MOLECULAR)	3382
Beams and Their Reactions	3382
Atomic and Molecular Properties	3383
Positronium, Muonium, and Muonic and Mesic Atoms and Molecules	3384
Collision Phenomena	3385
Atomic Theory	3387
PHYSICS (ELECTROFLUID AND MAGNETOFLUID)	3389
PHYSICS (HIGH-ENERGY)	3390
Particle Interactions and Properties (Experimental)	3390
Electromagnetic	3390
Weak	3390
Strong (Baryon-induced)	3390
Strong (Meson-induced)	3392
Particle Interactions and Properties (Theoretical)	3393
General	3393
Electromagnetic	3394
Weak	3396
Strong (General)	3397
Strong (Baryon No. = 0)	3398
Strong (Baryon No. = 1)	3399
Strong (Baryon No. ≥ 2)	3400
Particle Invariance Principles and Symmetries	3400
General	3400
Applications (Electromagnetic and Weak)	3401
Applications (Strong)	3401
Scattering Theory	3402
PHYSICS (LOW-TEMPERATURE)	3404
Superfluidity	3404
Superconductivity	3404
Equipment and Devices	3408
PHYSICS (NUCLEAR)	3409
Neutron Interactions with Matter	3409
Nuclear Properties and Reactions, $A \leq 5$	3411
Nuclear Properties and Reactions, $6 \leq A \leq 19$	3411
Nuclear Properties and Reactions, $20 \leq A \leq 38$	3414
Nuclear Properties and Reactions, $39 \leq A \leq 58$	3414
PHYSICS (NUCLEAR) (Cont'd.)	
Nuclear Properties and Reactions, $59 \leq A \leq 89$	3415
Nuclear Properties and Reactions, $90 \leq A \leq 149$	3416
Nuclear Properties and Reactions, $150 \leq A \leq 189$	3418
Nuclear Properties and Reactions, $190 \leq A \leq 219$	3420
Nuclear Properties and Reactions, $A > 220$	3421
Nuclear Theory	3423
PHYSICS (RADIATION AND SHIELDING)	3428
Radiation Physics	3428
Radiation Protection Standards	3432
Radiation Source Calibration and Standardization	3432
Shielding Calculations and Experiments	3432
PHYSICS (THEORETICAL)	3433
General	3433
Quantum Field Theories	3434
Gravitation and General Relativity	3436
REACTOR TECHNOLOGY AND REGULATION	3438
Power Reactors, Non-Breeding, BWR-Type	3438
Power Reactors, Non-Breeding, PWR-Type	3442
Power Reactors, Non-Breeding, Graphite Moderated	3445
Power Reactors, Non-Breeding, Otherwise Moderated	3448
Power Reactors, Breeding	3449
Research, Test, and Experimental Reactors	3453
Production and Materials Testing and Processing Reactors	3455
Propulsion and Package Reactors	3455
Reactor Safety and Environmental Aspects	3456
Reactor Theory and Calculation	3461
Reactor Components and Accessories	3463
Reactor Fuels	3465
Reactor Control Systems	3466
Nuclear Power Plant Economics	3467
Reactor Fuel Cycle Economics	3469
Reactor Licensing and Regulation	3470
GENERAL	3472
Civilian Defense	3472
Energy Utilization and Economics	3472
Information Handling	3473
Law	3474
Management	3474
Mathematics and Computers	3475
Miscellaneous	3479
Chemistry	3480
Life Sciences	3480
Materials	3482
Physics and Engineering	3483
CORPORATE INDEX	INDEX-1
PERSONAL AUTHOR INDEX	INDEX-20
SUBJECT INDEX	INDEX-74
REPORT NUMBER INDEX	INDEX-220

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Use of funds for printing this publication approved by the Director of the Office of Management and Budget, June 19, 1972.

controllable impurity or lattice defects. Luminescence of $LaNbO_4$–Ho crystals is effectively excited by gamma rays at 77 and 308°K. The excitation energy is transmitted to both holmium ions and local centers not associated with holmium. (SJR).

31623 EFFECT OF OXYGEN ABSORPTION DURING GAMMA IRRADIATION ON THE ELECTRICAL CONDUCTIVITY OF PbS AND ZnS. Kalamazov, R. U.; Kokkozov, R. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 3, 98-99(1974). (In Russian).

The thermal absorption of oxygen on PbS and ZnS take place in the form of a charged molecular ion O_2^-. The radiation chemisorption of oxygen initially causes a decrease in the electrical resistance of PbS and ZnS. However, on PbS after 3 hours and on ZnS after 15 hours there occurs an equilibrium in the rate of formation of electrons by irradiation and the capture of electrons by the adsorbed oxygen, and the resistance rises for PbS or remains stationary for ZnS. This result indicates a correlation between the adsorptive ability of the semiconductor and the width of its forbidden zone. (SJR)

31624 RADIOLYSIS OF POTASSIUM PERCHLORATE IN MIXTURES WITH ALUMINA. Nevostruev, V. A.; Zakharov, Yu. A.; Sizikov, A. M.; Volkina, T. M. (Tomsk Polytechnical Inst., USSR). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 156-157(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 186-187(1974).

The radiolysis of powdered $KClO_4$ is powdered Al_2O_3 at Al_2O_3 concentrations from 1 to 90 wt.% was studied to determine if secondary processes involving the transfer of thermal electrons through the separation surface accounts for the variation in the radiation yield for the decomposition of an unstable compound. The mixtures were irradiated with 1.5-MeV electrons at a dose rate of 1.7×10^{18} eV/g. The formation of products and decomposition of ClO_4^- ions varied linearly with the dose, and the yields of the products increased with increasing Al_2O_3 content. Irradiations were also carried out on tablets consisting of $KClO_4$ and Al_2O_3, on some of which an Al layer had been deposited and on some a layer of stearic acid. The G values obtained from these systems showed that electron transfer in the $KClO_4$ + Al_2O_3 system leads to a decrease in the radiation stability of $KClO_4$. (JSR)

31625 RADIATION-SENSITIZED CROSSLINKING OF FLUORINATED ELASTOMERS WITH OLIGOESTERACRYLATES. Makhlis, F. A.; Nikitin, L. Ya.; Arkina, S. N.; Kuz'minskii, A. S. (Scientific-Research Inst. of the Rubber Industry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 152-153(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 183-184(1974).

The effect of the unsaturated oligoesteracrylates (OEA)–triethylene glycol dimethacrylate (TGM-3), tetramethacrylate of diglyceryl phthalate (TMGP-11), and octamethacrylate of dipentaerythrityl adipate (7-20)—on the rate of radiolytic crosslinking of the copolymers of vinylidene fluoride with hexafluoropropylene (SKF-26) and with trifluorochloroethylene (SKF-32) was investigated. The γ irradiations were made under air-free conditions at 20 to 25°C at a dose rate of 0.9 Mrad/hr. The efficiency of the radiation-sensitized crosslinking of the fluorinated rubbers depends on the type and amount of OEA present. Infrared measurements indicated the occurrence of three-dimensional graft polymerization of the OEA within the fluorinated rubbers. The sensitization efficiency of the OEA decreases in the series: 7-20, TMGP-11, and TGM-3. (JSR)

31626 RADIATION EFFECTS ON CHLOROBENZOIC ACIDS IN AQUEOUS SOLUTIONS. Shamdasani, N. K.; Rao, K. N. (Bhabha Atomic Research Centre, Bombay). Radiat. Eff.; 21: No. 2, 91-97(1974).

The effect of gamma rays on aqueous solutions of orthochlorobenzoic acid (OCBA), metachlorobenzoic acid (MCBA), and parachlorobenzoic acid (PCBA) were studied. The H atom rate constants for OCBA and MCBA have been determined in a degassed solution of 0.8 N H_2SO_4 using isopropanol as the competitor and determining $G(H_2)$ at different concentration ratios of the competitors. Similarly, the OH radical rate constants were determined for all three chlorobenzoic acids at pH 7.0 in oxygenated solution using isopropanol as the competitor and measuring acetone yields at different concentration ratios of the chlorobenzoic acids and isopropanol. The hydrated electron rate constants were measured at pH 11 by measuring the decay of the e_{aq}^- in presence of the chlorobenzoic acids. $G(CO_2)$, $G(H_2O_2)$ and $G(Cl^-)$ were also measured and their yields are discussed. Paper chromatography of the products revealed 4 to 6 components in each case. (auth)

31627 ESR STUDY OF THE RADIOLYSIS PRODUCTS FROM POLYCRYSTALLINE TRIETHYLENEDIAMINE COMPLEXES OF Co(III) AND Rh(III). Glazkov, Yu. V.; Zotov, N. I.; Il'yukevich, L. A.; Neokladnova, L. N.; Pansevich, V. V. (Belorussin State Univ., Minsk). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 147-149(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 179-181(1974).

Normal and deuterated triethylenediamine complexes of Co(III) and Rh(III) were irradiated at 77°K in the polycrystalline form with x radiation and ^{60}Co γ radiation at doses from 0.1 to 7 Mrad. The ESR spectra of the normal and deuterated complexes were obtained in order to determine the nature of the primary products. From an analysis of the hfs lines of the ESR spectra, assignments were made of the paramagnetic centers observed. The observation of the signals at low radiation doses confirmed that the signals came from primary radiolysis products. (JSR)

31628 RADIOLYSIS OF SOLUTIONS OF STABLE 2,2,6,6-TETRAMETHYLPIPERIDINE-1-OXYL RADICALS IN METHANOL AT ROOM TEMPERATURE. Abdrashitov, E. F.; Tikhomirov, L. A. (Inst. of Chemical Physics, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 145-146(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 177-178(1974).

The radiolysis of solutions of the stable radical 2,2,6,6-tetramethylpiperidine-1-oxyl (R_{st}) in methanol at room temperature was studied to determine the yields of H and CH_2OH. Degassed solutions were irradiated with ^{60}Co γ rays at a dose rate of ~0.15 Mrad/min. The yields of H, ethylene glycol, and formaldehyde were determined by mass spectroscopy, chromatography, and photometry, respectively. The R_{st} concentration changed almost linearly with irradiation and the addition of lead dioxide to the irradiated solution restores the R_{st} concentration to almost its initial value. The presence of the stable radical inhibits the formation of hydrogen and ethylene glycol as neither reach the values obtained in the radiolysis of pure methanol. With respect to formaldehyde its yield is appreciably higher in the initial stages of radiolysis, but in the final stages the value is reduced to that for pure methanol. The probable reaction mechanism for these results is reported. (JSR)

31629 GAMMA RADIOLYSIS OF AIR-SATURATED AQUEOUS SOLUTIONS OF PROPYL ALCOHOLS. Pribush, A. G.; Brusentseva, S. A.; Shubin, V. N.; Dolin, P. I. (Inst. of Electrochemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 137-139(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 167-170(1974).

The mechanism of the radiolysis of air-saturated aqueous solutions of the propyl alcohols was investigated. From the results it is suggested that the reaction of α-hydroxypropyl radicals with oxygen is reversible. The value found for the equilibrium constant of this reaction was $3.36 \cdot 10^6$ liter/mole. It was found that the rate of reaction of "alcohol" radicals with hydrogen peroxide depends on the structure of the alkyl group of the radical. (auth)

31630 THERMAL QUENCHING OF THE RADIOPHOTOLUMINESCENCE OF POLYETHYLENE. Kulakov, V. V.; Nikol'skii, V. G. (Inst. of Chemical Physics, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 129-133(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 156-161(1974).

The thermal quenching of the radiophotoluminescence (RPL) of low density polyethylene (Alkathene-WJG-11) exposed to various irradiation doses was investigated. Starting at about 120°K the emission intensity and the average duration of the RPL decreased with increased temperature for all samples. It was concluded that internal quenching of excited triplet molecules occurs, arising from the development of a γ_a relaxation transition in the amorphous phase of the polymer. A correlation was found between the decay period of the RPL and the concentration of alkyl radicals. (auth)

31631 TRAPPED ELECTRONS IN THE LOW-TEMPERATURE RADIOLYSIS OF PROPYLENE CARBONATE. Kostin, A. K.; Kulakov, V. V. (Inst. of Electrochemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 125-128(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 151-155(1974).

ESR, radiothermoluminescence, and optical spectroscopic methods were used to study trapped electrons (e_{tr}^-) in glassy propylene carbonate at 77°K. The ESR signal of e_{tr}^- is Gaussian, with $\Delta H = 4.7$ Oe and a significant contribution by homogeneous broadening, while $G(e_{tr}^-) = 0.3$. In the optical spectrum the absorption due to e_{tr}^- produces a complex band in the visible region, with $\nu_{1,max} = 1.45 \cdot 10^4$, $\nu_{2,max} = 1.56 \cdot 10^4$ cm^{-1}, and halfwidth $\Delta\nu = 0.35$ eV. From the resolved structure of the optical spectrum and the ESR results it was possible to evaluate $\Delta\nu$, the extinction coefficient, and the oscillator strength of the transitions. (auth)

31632 OXYGEN AS AN INHIBITOR OF HCN FORMATION IN THE RADIOLYSIS OF N_2–CH_4 MIXTURES. Zhdamirov, G. G.; Kornienko, V. N.; Borisov, E. A. (Physical Chemistry Inst.,

Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 122-124(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 147-150(1974).

The inhibiting effect of small additions of oxygen on the formation of hydrogen cyanide from irradiated N_2-CH_4 mixtures has been investigated. It was found that ~1 vol. % oxygen almost completely inhibits HCN formation. A possible mechanism is discussed and calculations made of the stationary concentrations of both ions and radicals important in the formation of HCN in the system $N_2-CH_4-O_2$. The rate of formation calculated on the basis of a suggested kinetic scheme satisfactorily describes the experimental results. (auth)

31633 PHOTOEMISSION STUDIES OF THE BEHAVIOR OF SOLVATED ELECTRONS AND UNSTABLE SPECIES (A REVIEW). Pleskov, Yu. V.; Rotenberg, Z. A. (Inst. of Electrochemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 83-97(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 99-117(1974).

Recent advances in the use of photoemission methods in the study of solvated electrons and unstable species are reviewed. The principles of the method are described. The application of the method to the determination of the energy characteristics of excess electrons in polar liquids, photodiffusion phenomena, measurement of rate constants for the reaction of solvated electrons with scavengers, and the study of stable and unstable intermediate products is discussed. Typical results that can be expected from each of these applications are reported. (48 references) (JSR)

31634 RADIOLYTIC DECOMPOSITION OF PROPANE AND CYCLOPROPANE IN RELATION TO THEIR STRUCTURES. Zhitneva, G. P.; Kozhemyakina, L. F.; Pshezhetskii, S. Ya. (Physical Chemistry Inst., USSR). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 150-151(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 181-182(1974).

The γ radiolysis of propane and cyclopropane was studied in the liquid phase at −78°C at dose rates from 611 to 2475 rad/sec under identical conditions in order to determine whether the structure of the molecule affects the nature and direction of its radiolytic decomposition. The radiation yields of the products were tabulated and showed that in propane the principal process is C−H bond rupture and H_2 formation whereas in cyclopropane the principal process was C−C bond rupture and the formation of lower hydrocarbons. In a comparison of the radiolytic behavior of cyclic and straight-chain hydrocarbons as a function of the number of C atoms, examination of literature data indicated that during the radiolysis of the higher cycloalkanes, in which the C−C bond stability is the same as in the saturated hydrocarbons, there are no significant differences from the open chain compounds. (JSR)

31635 CHEMILUMINESCENCE OF SODIUM ZINC GERMANATE (Na_2ZnGeO_4) IRRADIATED WITH GAMMA RAYS. Yunusov, M. S.; Lobachev, A. N.; Kuz'minina, I. P.; Grinchenko, G. P.; Sultanov, A. S. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 3, 94-95(1974). (In Russian).

Crystals of Na_2ZnGeO_4 were irradiated with ^{60}Co gamma rays. On dissolving the irradiated sample in 0.1 to 0.5 N HCl, a chemiluminescence was observed. The light yield was proportional to the gamma dose with no sign of saturation. This compound is sensitive to gamma radiation, and can be used as a dosimeter of gamma radiation up to a dose of 1000 R. (SJR)

31636 CONDUCTOMETRIC PULSE RADIOLYSIS STUDY ON THE REACTION OF THE SOLVATED ELECTRON WITH 5-BROMOURACIL IN AQUEOUS SOLUTIONS AT DIFFERENT pH VALUES. Wagner, B. O.; Klever, H.; Schulte-Frohlinde, D. (Max-Planck-Institut fuer Kohlenforschung, Muelheim an der Ruhr (F.R. Germany)). Z. Naturforsch., b; 29: No. 1/2, 86-88(Jan 1974).

1 tab.; 10 refs.

To study the reaction of solvated electrons with 5-bromouracil an aqueous solution was examined by conductometric pulse radiolysis at pH values between 4.68 and 8.74. Alcohol was added to scavenge the hydrogen atom and the hydroxyl radical. $G(Br^-) = (2.64 \pm 0.08)/100$ eV was found to be independent of the pH. The mobility of the bromouracil mono-anion was measured to be $(2.7 \pm 0.2)10^{-4} cm^2V^{-1}s^{-1}$ at 20°C. (auth)

31637 REACTIONS OF OH-RADICALS WITH ACETALDEHYDE IN OXYGENATED AQUEOUS SOLUTION. Schultze, H.; Schulte-Frohlinde, D. ((Max-Planck-Institut fuer Kohlenforschung, Muelheim an der Ruhr (F.R. Germany). Abt. fuer Strahlenchemie). Z. Naturforsch., b; 29: No. 1/2, 91-95(Jan 1974). (In German).

3 figs.; 10 refs.

γ-irradiation of aqueous acetaldehyde in the presence of N_2O and O_2 at 0°C leads to the formation of 1.5 molecules of acetic acid per OH radical consumed. As intermediates, peroxidic compounds are produced with a half life of about 50 min. H_2O_2 is not formed. At temperatures above 10°C, a chain reaction takes place leading to acetic acid with a G-value of 40 at 40°C. The propagating species are the acetylperoxy and the acetyl radicals. The reaction steps are addition of oxygen to the acetyl radicals and transfer of hydrogen from acetaldehyde to the acetylperoxy radical leading to peracetic acid. In this reaction no hydrogen peroxide is formed. (auth)

31638 GAS CHROMATOGRAPHIC, MASS SPECTROMETRIC INVESTIGATION OF IRRADIATED OR HEATED FATS, OILS AND MODEL SUBSTANCES. Beck, B. Weihenstephan, Ger.; Technische Univ. Muenchen (1973). 121p. (In German). INIS.

Thesis. 23 figs.; 36 tabs.; 51 refs. With abstract. Available from the library of the Technische Univ. Muenchen.

Tripalmitate, tristearate, trioleate, oleic acid methyl ester, linoleic acid methyl ester, lauric acid, lard, palmin, sunflower oil, and olive oil were irradiated in the linear accelerator with 0.5 to 6 Mrad. After separation of the hydrocarbons from the oxygen compounds on silica gel using pentane or pentane−ether as an elutropic series, 28 hydrocarbons and 24 oxygen compounds were gas chromatographically separated and identified by means of mass spectrometry. The radical mechanisms are discussed on the basis of the fission products found and using the literature. These results led to comparative investigations of heated fats. After heating for 24 hours to 170°C, 28 hydrocarbons and 1 oxygen compound were gas chromatographically separated and mass spectrometrically identified. When heating, cyclohexenes occur in addition to the after irradiation identified compounds, which permit a distinction between irradiation and heating. From the outer layers of smoked ham, a series of compounds could be gas chromatographically detected and partly identified by mass spectrometry. (GE)

31639 GAS CHROMATOGRAPHIC ANALYSIS OF REACTION PRODUCTS FROM CHEMICAL IRRADIATION. Weeke, F.; Bastian, E.; Schomburg, G. (Max-Planck-Institut fuer Kohlenforschung, Muelheim an der Ruhr (F.R. Germany). Abt. fuer Kohlenforschung, Muelheim an der Ruhr (F.R. Germany). Abt. fuer Strahlenchemie). Chromatographia; 7: No. 4, 163-170(Apr 1974). (In German).

8 figs.; 7 refs.

The products of chemical irradiation can be regarded, from the gas chromatographic point of view, as being complex mixtures whose analyses are made difficult by the large differences in volatility and concentration of the various components. Special techniques must be used in the sample preparation and introduction as well as in the exclusive separation and determination of the components of particular interest. An important role in this process is played by double column techniques with "heart-cutting," "backflushing" and "trapping" in an automatically controlled closed system. (auth)

31640 RADIATION COPOLYMERIZATION OF FLUOROOLEFINS. Naberezhnykh, R. A.; Dorokin, A. D.; Volkova, E. V.; Fokin, A. V. Bull. Acad. Sci., USSR, Div. Chem. Sci. (Engl. Transl.); 23: No. 1, 227-228(Jan 1974).

Translated from Izv. Akad. Nauk SSSR, Ser. Khim.; 23: No. 1, 232-233(Jan 1974).

The constants for the radiation copolymerization of tetrafluoroethylene (TFE) with ethylene, vinyl fluoride, vinylidene fluoride, trifluoroethylene, trifluorochloroethylene and hexafluoropropylene were determined. Based on the relative reactivity in the reaction with the polymeric radical, terminated by a TFE unit, the studied monomers can be arranged in the following order of decreasing activity: $CH_2 = CH_2 > CH_2 = CHF > CH_2 = CF_2 > CF_2 = CFCL > CF_2 = CF_2 > CHF = CF_2 \gg CF_2 = CF - CF_3$. (auth)

31641 THERMAL DESTRUCTION OF POLY(VINYL FLUORIDE) OBTAINED BY RADIATION METHODS UNDER DIFFERENT CONDITIONS. Sirlibaev, T. S.; Gubareva, L. L.; Usmanov, Kh. U.; Yul'chibaev, A. A. (Tashkent State Univ.). Uzb. Khim. Zh.; No. 3, 55-56(1974). (In Russian).

The thermal destruction of samples of poly(vinyl fluoride) obtained under the effects of ^{60}Co γ-radiation and in the presence of the solvents CCl_4, 1,1-dichlorethane, N,N-dimethyl fluoride, and benzene is discussed. By the synthesis of poly(vinyl fluoride) in solution its thermostability was impaired. (tr-auth)

31642 PULSE RADIOLYSIS AND POLAROGRAPHY: POLAROGRAMS AND STRUCTURE OF SHORT-LIVED FREE RADICALS. Bansal, K. M.; Henglein, A.; Sellers, R. M. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R.

Germany). Sektor Strahlenchemie). Ber. Bunsenges. Phys. Chem.; 78: No. 6, 569-575(Jun 1974).

9 figs.; 23 refs.

The irreversible oxidation and reduction waves of some 20 radicals were investigated. They are discussed with respect to the structure of the radicals and the mechanisms of the electrode processes involved. The effects that influence the position and shape of polarographic waves include double bond formation during the electron transfer, protonation of the radicals, differences in the atomic configuration, and solvent interactions between the radicals and their electrochemical products. The observed polarographic waves are also discussed with respect to possible distributions of occupied and unoccupied electronic levels of the systems $R \rightarrow R^+$ and $R \rightarrow R^-$ (R = radical). (auth)

31643 FORMATION OF IONS AND EXCITED STATES IN THE PULSE RADIOLYSIS OF BENZONITRILE. Kira, A.; Thomas, J. K. (Univ. of Notre Dame, IN). J. Phys. Chem.; 78: No. 21, 2094-2098(10 Oct 1974).

Transient ionic and excited species in liquid benzonitrile and solutions of solutes in benzonitrile were investigated using nanosecond pulse radiolysis. The radiolysis of several aromatic solutes gave rise to the cations of these solutes and the yields were determined to be 1.4 ions/100 eV. Anions of the solutes were also detected for all solutes apart from trans-stilbene. The effects of ammonia, sulfur hexafluoride, and nitrous oxide on the yield of ionic species suggest that the precursors of the solute ions are cations and anions of benzonitrile. Solute excited states are also observed, and the G values for the excited singlet and triplet states were determined to be 0.7 and 1.4, respectively. The mechanism of formation of the excited states is discussed. (auth)

31644 INDIRECT MEASUREMENTS FOR THE TIME DEPENDENCE OF THE HYDRATED ELECTRON. Jonah, C. D. (Argonne National Lab., IL). J. Phys. Chem.; 78: No. 21, 2103-2105 (10 Oct 1974).

Two indirect methods used for determining the yield of the hydrated electron as a function of time, the steady-state concentration method and the Laplace transform method, were examined. The experimental difficulty in measuring rate constants at high concentrations and the errors in neglecting certain intraspur reactions lead to errors consistent with the differences between the experimentally observed and the indirect measurements for the decay of the hydrated electron. (auth)

31645 PULSE RADIOLYTIC INVESTIGATIONS OF $OHCH_2O_2$ RADICALS. Rabani, J. (Hebrew Univ., Jerusalem); Klug-Roth, D.; Henglein, A. J. Phys. Chem.; 78: No. 21, 2089-2093(10 Oct 1974).

Methanol radicals CH_2OH react with oxygen and produce peroxy radicals O_2CH_2OH, $k_{CH_2OH+O_2} = (4.2 \pm 0.5) \times 10^9\ M^{-1}\ sec^{-1}$. O_2CH_2OH ionizes to form $O_2CH_2O^-$, which quickly decomposes to CH_2O and O_2^-. The ionization is catalyzed by OH^- and by HPO_4^{2-}. $k_{O_2CH_2OH+OH^-} = (1.8 \pm 0.9) \times 10^{10}\ M^{-1}\ sec^{-1}$ and $k_{O_2CH_2OH+HPO_4^{2-}} \simeq 2 \times 10^8\ M^{-1}\ sec^{-1}$ were measured. The spontaneous ionization rate constant $k_{O_2CH_2OH \rightarrow O_2CH_2O^- + H^+} < 3\ sec^{-1}$ was estimated. The pK of O_2CH_2OH was estimated to be higher than 6, and probably >8.8. Previous reports of more accurate determinations of pK values of peroxy radicals should be reconsidered, in view of the possible instability of the basic form of the peroxy radicals. The absorption spectrum of O_2CH_2OH was determined. ϵ 1070 $M^{-1}\ cm^{-1}$ was measured at 248 nm. At relatively high pulse intensities, formation of O_2^- from O_2CH_2OH is inhibited, and a second-order process that competes with the unimolecular formation of O_2^- from $O_2CH_2O^-$ is proposed. (auth)

31646 ELECTRON SPIN RESONANCE OF PALLADIUM(I). IV. Mixed-Ligand Complexes of Palladium. Nakamura, M.; Fujiwara, S. (Tokyo Univ.). J. Phys. Chem.; 78: No. 21, 2136-2140 (10 Oct 1974).

ESR spectra were obtained for mixed-ligand complexes of palladium(I), which were formed in frozen solutions of the complexes of palladium(II) by γ irradiation. The g values for $Pd^I Cl_{4-n} L_n$ (n = 0–4 for L = ammonia, ethylamine, n-butylamine, NO_2^-, and SCN^-; n = 0–2 for L = di-n-butylamine and tri-n-butylamine), $Pd^I (C_2O_4) L_2$ (L = ammonia, NO_2^-, and SCN^-), and $Pd^I (OCOCH_3)_m L_n$ (n = 0–4 for L = n-butylamine; n = 0–3 for L = pyridine) were determined. Two spectra observed for frozen solutions of diacetato- or dipropionatopalladium(II) in toluene were attributed to monomeric and trimeric species. (auth)

31647 PART I. AN X-RAY CRYSTALLOGRAPHIC STRUCTURE DETERMINATION OF BROMOMALONAMIDE. Part II. An ESR Study of Radicals in Single Crystals of γ-Irradiated Bromomalonamide and Iodoacetamide. Picone, R. F. East Lansing, MI; Michigan State Univ. (1974). 155p. University Microfilms Order No. 74-19,859.

Thesis (Ph. D.).

No carbon-centered radicals with bromine or iodine substituents had previously been studied by single-crystal ESR methods. The purpose of this work was to obtain examples of such radicals, carry out analyses of their ESR spectra, and use the ESR parameters to deduce their structures. In order to interpret the ESR spectra of single crystals in the most thorough manner, crystallographic data are desirable for the host crystal. It proved necessary to obtain such information in this work since no previous crystallographic investigations of the materials used had been carried out. The principal results of this investigation are summarized below: The crystal structure of bromomalonamide, $HBrC(CONH_2)_2$, has been determined from MoK_α diffractometer data by use of Patterson and Fourier syntheses. Both powder and single-crystal ESR spectra of paramagnetic species formed by γ-irradiation of bromomalonamide at 77°K were obtained. One radical shows a large bromine hyperfine interaction plus a small proton interaction and g, A(^{81}Br) and $e^2qQ(^{81}Br)$ tensors were determined from an analysis of the spectra of the deuterated form. The data were interpreted as favoring the structure $\cdot CHBrCONH_2$ for this species. The second fragment was identified as $\cdot CONH_2$ but ESR parameters are not reported since it was studied previously. Neither species is stable at room temperature in the host crystal. Powder and single-crystal ESR spectra of iodoacetamide, γ-irradiated and observed at 77°K, were analyzed. Hyperfine interaction with one iodine and one hydrogen nucleus is observed and the A(^{127}I), A(H), g and $e^2qQ(^{127}I)$ tensors have been found. These data indicate that the radical species is the π-electron radical, $\cdot CHICONH_2$, and are consistent with a planar or nearly planar structure. The g and A(^{127}I) tensor are axial, or nearly so. The odd-electron spin densities in the iodine 5s and $5p_z$ orbitals are larger than found for the halogens in the analogous fluoro- and chloro-radicals, but are comparable with the values found for bromine in $\cdot CHBrCONH_2$. (Diss. Abstr. Int., B)

31648 RADIATION CHEMICAL CONVERSIONS OF IODINE IN THE SYSTEM TRIBUTYL PHOSPHATE – HEXANE – H_2O – HNO_3. Zagorets, P. A.; Raskina, Z. I.; Bulgakova, G. P.; Makarov, V. M.; Sazhina, T. G.; Agafonova, T. N. Sov. At. Energy (Engl. Transl.); 34: No. 3, 261-263(Mar 1973).

Translated from At. Energ. (USSR); 34: No. 3, 205-207(Mar 1973).

The radiation chemical behavior of iodine in TBP and in solutions of TBP in hexane was investigated. The role of H_2O and HNO_3 additives in the processes of radiolysis was studied. (LK)

31649 GAMMA-INDUCED ADDITION REACTION OF METHANOL TO METHYL OLEATE. Sugii, A.; Shimada, S.; Nagai, K.; Kitahara, K. (Kumamoto Univ., Japan). Chem. Lett. (Tokyo); No. 3, 211-214(Mar 1974).

Methyl 9- and 10-methoxystearates were obtained by the γ-induced addition reaction of methanol to methyl oleate in the absence or presence of methanol. Yield of the adducts increased with the increase of methanol added in the reaction systems. (auth)

31650 ESR STUDY OF FREE RADICALS IN γ-IRRADIATED $KH_3(SeO_3)_2$. Sergeev, N. A.; Falaleev, O. V. (Inst. of Physics, Krasnoyarsk, USSR). J. Struct. Chem. (USSR) (Engl. Transl.); 15: No. 2, 205-208(1974).

Translated from Zh. Strukt. Khim.; 15: No. 2, 222-226(1974).

The ESR spectra of γ-irradiated single crystals and polycrystalline specimens of $KH_3(SeO_3)_2$ have been studied in the temperature range from – 180 to + 70°C (mp). The radicals responsible for the ESR spectrum have been identified as SeO_3^-. The g-tensor and the tensor of the hyperfine interaction and also the orientation of the radical in the structure have been determined. (auth)

31651 OXIDATION OF Fe^{2+} – Cu^{2+} SULFURIC ACID SOLUTIONS BY LOW ENERGY PROTONS. Julien, R.; Pucheault, J. (CNRS, Ivry-sur-Seine, France). J. Chim. Phys.; 71: No. 5, 808-809(May 1974). (In French).

The radiolysis by protons at an energy range between 75 and 350 keV, of aqueous Fe^{2+} – Cu^{2+} sulfuric acid solutions confirmed the results obtained from other system studies: Fe^{2+}, Ce(IV), Ce(IV)-Tl(I). $G_{H_2O_2}$ has about the same value whatever energy may be and the radical yields G_H and G_{OH} become null for proton energy E ≈ 100 keV, that is to say at maximal LET. (FR)

31652 STUDIES ON THE CATALYTIC ACTIVITY OF WATERS FROM WEAKLY RADIOACTIVE SOURCES. Part I. Influence of Weakly Radioactive Waters on the Peroxidative Oxidation of Indigo-Carmin. Szmytowna, M.; Umbreit, M. H. (Medical Academy, Poznan, Poland). Ann. Pharm. (Poznan); 10: 51-57 (1973). (In Polish).

Peroxidative oxidation of indigocarmin was studied, using H_2O_2, versus the time and radiation dose (0.6 to 4.8 μ Ci/dcm^3)

originating from radium and decay products of ^{226}Ra. The peroxidative oxidation rate of indigocarmin decreased with growing dose of the radioactive substance; a dose of as little as 0.6 μ Ci/dcm^3 was sufficient to influence the course of the process. (auth)

31653 ESR SPECTROSCOPY OF RADIATION-PRODUCED RADICALS IN 9-ETHYLADENINE. Flossmann, W.; Westhof, E.; Mueller, A. (Univ., Regensburg, Ger.). Int. J. Radiat. Biol.; 25: No. 5, 437-443(May 1974).

Radical formation in monocrystals of 9-ethyladenine by irradiation with x rays at room temperature has been studied using esr spectroscopy at 9.5 GHz and 35 GHz. The two types of spectra found were attributed to hydrogen abstraction and addition radicals. It was possible to separate the correlated spectra and to assign definite structures to the two species by analyzing the orientational variations of the spectra. The spectra of the abstraction radical were obtained under conditions of power saturation of the addition radical at reduced temperature (77°K). The site of hydrogen dissociation and of maximum unpaired spin density was localized at the C-10-carbon atom bound to N-9 of the purine. The methyl β-protons give isotropic splittings of 24.0 G each. The abstraction radical could be bleached by illumination with uv light, leaving the addition radical unchanged. Hydrogen addition was concluded on the basis of isotropic hyperfine interactions from two β-protons of 39.5 G each and anisotropic splittings from two nitrogen nuclei with axial symmetry. Theoretical splittings calculated with the INDO method indicate addition at the C-8-atom. Principal values of the nitrogen splittings perpendicular and parallel to the purine ring are 27.0 G and 0.0 G for N-7, 6.6 G and 0.0 G for N-9. (auth)

31654 ESR AND ENDOR STUDIES OF RADIATION DAMAGE. Box, H. C. (Roswell Park Memorial Inst., Buffalo). J. Magn. Resonance; 14: No. 3, 323-328(Jun 1974).

The use of ENDOR to characterize hyperfine couplings in radicals produced by ionizing radiation in organic compounds is discussed. The main use of ENDOR in radiation research has been to sort out superimposed ESR adsorptions. The following radiation products have been identified from ENDOR measurements on single crystals: (1) two stable hydrogen-adduct radicals produced in irradiated methyl cytosine, (2) the primary oxidation and reduction products produced in chloropropionamide irradiated at 4.2°K, and (3) a primary oxidation product and two primary reduction products produced in glycylglycine HCl irradiated at 4.2°K. (auth)

31655 ESR STUDY OF THE .CHICHONH$_2$ RADICAL IN γ-IRRADIATED SINGLE CRYSTALS OF IODOACETAMIDE. Picone, R. F.; Rogers, M. T. (Michigan State Univ., East Lansing). J. Magn. Resonance; 14: No. 3, 279-285(Jun 1974).

Powder and single-crystal ESR spectra of iodoacetamide, γ-irradiated and observed at 77°K, were analyzed. Hyperfine interaction with one iodine and one hydrogen nucleus is observed and the A(^{127}I), A(H), g, and e^2qQ(^{127}I) tensors were found. These data indicate that the radical species is the π-electron radical .CHICONH$_2$, and are consistent with a planar or nearly planar structure. The g and A(^{127}I) tensors are axial, or nearly so. The odd-electron spin densities in the iodine 5s and 5p orbitals are larger than found for the halogens in the analogous fluoro- and chloro-radicals but are comparable with the values found for bromine in .CHBrCONH$_2$. (auth)

31656 ^{60}Co-GAMMA RADIOLYSIS OF CYSTEINE IN AERATED AND OXYGEN SATURATED IN PERCHLORIC ACID SOLUTIONS. Lal, M. (Bhabha Atomic Research Centre, Bombay). Radiat. Eff.; 22: No. 1, 49-52(May 1974).

Gamma radiolysis of cysteine in aerated and oxygen saturated acidic solutions leads to a chain decomposition of the solute with a corresponding formation of cystine and cysteine sulphinic acid. A reaction mechanism to explain the experimental yields is proposed and a rate expression for G(–CySH) evaluated. It is found that the calculated and experimental G(–CySH) are in excellent agreement. It is also found that G(CyS–SCy) and G(H_2O_2) increase with decreasing dose rate (I). G(CyS–SCy) and G(H_2O_2) plotted against $1/\sqrt{I}$ are straight lines suggesting a radical–radical chain termination step. (auth)

31657 ENDOR AND ESR STUDIES OF A STABLE RADICAL IN IRRADIATED CYTIDINE. Allison, D. L. (Florence State Univ., AL); Alexander, C. Jr. J. Magn. Resonance; 14: No. 3, 366-373(Jun 1974).

A stable radical species formed by x-irradiation in a single crystal of cytidine has been studied by electron nuclear double resonance (ENDOR) and electron spin resonance (ESR) techniques at room temperature. The results show hyperfine coupling of an unpaired electron to one hydrogen nucleus. The radical has two slightly different geometrical form (A,B) with small differences in hyperfine couplings. The principal values of the hyperfine tensors are as follows: A: 27.76, 31.93, 28.06 MHz, and B: 29.18, 33.42, 29.51 MHz. The g factor principal values are 2.0021, 2.0043, 2.0057. These data indicate a radical formed in the ribose sugar group with a hydrogen atom in a β position coupling to a spin density of approximately 0.2 on a carbon atom. (auth)

31658 TRANSIENT SPECIES IN RADIOLYSIS OF MELTED ALKALI METAL HALIDES. Makarov, I. E.; Zhukova, T. N; Pikaev, A. K. (Inst. of Chemical Physics, Moscow). Radiat. Eff.; 22: No. 1, 71-72(May 1974).

A study is presented of the pulse radiolysis of melted alkali metal halides, with optical (spectrophotometric) detection of short-lived species. The melts of NaCl, KCl, NaBr, KBr, NaI, KI, CsBr and CsI were irradiated by single electron pulses of 5 MeV. The spectra of the transients are shown and discussed. (UK)

31659 THYMINE DIMER SPLITTING BY IONIZING RADIATION. Grossweiner, L. I.; Kepka, A. G.; Santus, R.; Vigil, J. A. (Illinois Inst. of Tech., Chicago). Int. J. Radiat. Biol.; 25: No. 5, 521-523(May 1974).

The mechanism of the cleavage of thymine dimers was studied by a method based on pulse radiolysis (1 μsec pulses of 30 MeV electrons, 700 rads/pulse, spectrophotometric detection) and ^{60}Co irradiation G values (dose-rate 1.3 krads/min). Thymine formation was followed by the optical absorption increase at 265 nm, and thin layer chromatography with labelled thymine dimer. The relevance of the results to the splitting by enzymatic photoreactivation of thymine dimers produced in DNA by uv-irradiation is discussed. (UK)

31660 RADICAL YIELD IN X-IRRADIATED BIOLOGICAL MOLECULES. II. Naturally-Occurring Amino-Acids. Crippa, P. R.; Tedeschi, R. A.; Vecli, A. (Univ., Parma, Italy). Int. J. Radiat. Biol.; 25: No. 5, 497-504(May 1974).

ESR studies of the radiation effects in naturally occurring amino acids in the dry state are reported. Some magnetic properties of these irradiated materials are discussed and conclusions deduced about the kind and the distribution of the radiation stable damage. The results seem to question the significance of quantitative indices of radical yield, such as G_r. (auth)

31661 ELECTRON–ELECTRON DOUBLE-RESONANCE INVESTIGATIONS OF IRRADIATED ORGANIC CRYSTALS. The Influence of Deuterium Substitution. Kispert, L. D.; Chang, K.; Wang, P. S. (Univ. of Alabama, Tuscaloosa). J. Magn. Resonance; 14: No. 3, 339-347(Jun 1974).

Electron–electron double resonance (ELDOR) investigations of irradiated organic crystals have shown promising uses of deuterium substitution in the ELDOR identification of magnetically different radicals associated with a poorly resolved ESR spectrum. Replacement of the water of crystallization in potassium acetate with deuterium oxide has removed the proton spin-flip lines in the ELDOR spectrum of the methyl radical and has increased the ELDOR resolution observed at 77°K. Studies of the hydrogen-deuterium exchange reactions in irradiated glycine-d_5 and L-alanine crystals have shown the absence of ELDOR lines at the deuteron hyperfine frequency a_D and the absence of proton-deuteron combination lines, but the presence of an intense line at the proton hyperfine splitting frequency. In addition, a decrease in the intermolecular cross-exchange near room temperature permitted a separation of the proton ELDOR spectra for each hydrogen-deuterium exchange reaction, making it possible to identify the different simultaneously occurring reactions. (auth)

Radiochemistry and Nuclear Chemistry

Refer also to abstract 32437.

Hot-Atom Chemistry

31662 (COO-3283-8) STUDIES IN RADIATION AND HOT ATOM CHEMISTRY. Progress Report. (Johns Hopkins Univ., Baltimore, Md. (USA). Dept. of Chemistry). Sep 1974. Contract AT(11-1)-3283. 11p. Dep. NTIS $4.00.

The ion-molecule reactions of $F^+(^3P)$ and $F^+(^1D)$ with H_2, D_2, and HD were studied over an energy range from a few eV to 40 to 100 eV in the laboratory system. Likewise the charge transfer reactions of $F^+(Ne,F)Ne^+$ were examined for the two electronic states

of F^+. The exoergicity of the $F^+(D_2,D)FD^+$ reaction was determined. The charge distribution of ^{13}N ions arising from the reaction $^{12}C(d,n)^{13}N$ was measured for deuteron energies of 8, 10, and 14 MeV. With 30-$\mu g/cm^2$ carbon foils essentially an equilibrium charge distribution was observed. Departures from equilibrium were observed with foils of 16.3-$\mu g/cm^2$ thickness and 10-MeV deuterons. Beam attenuation studies of B^+ produced by electron fragmentation of boron trihalides showed that when BF_3 was used as a target molecule 35% ^3P state and 65% ^1S state was produced. BI_3, on the other hand, gave only ground state B^+. The results were consistent with reactions of B^+ with N_2O. Pair production was observed in the electron fragmentation of CF_4 and evidence for F^{2-} as a product was found in fragmentation of CF_3Cl. (auth)

31663 (RISO-311) STUDIES OF CHEMICAL AFTER-EFFECTS OF NUCLEAR REACTIONS. Fenger, J. (Danish Atomic Energy Commission, Risoe. Research Establishment). Jul 1974. 117p. Dep. NTIS (US Sales Only) $9.00.

A brief historical introduction is given to the study of the chemical effects of nuclear transformations and it is shown that these effects are of significance in other fields and may even be of practical importance. Various theories and models and the methods by which they may be tested are discussed. The available experimental techniques are reviewed with emphasis on those used in the studies described. The effects of $^{31}P(n,\gamma)^{32}P$ reactions in phosphorus oxyanions are first considered and are mainly conventional hot-atom studies based on radiochemical analyses of reactor-irradiated samples. The results of studies of $^{58}Fe(n,\gamma)^{59}Fe$ reactions are then discussed. Although the experimental techniques are conventional, the approach is changed by using compounds in which the nuclear reactions can take place at different sites. Moessbauer experiments with ^{57}Fe, produced either by $^{56}Fe(n,\gamma)^{57}Fe$ reactions or by $^{57}Co(EC)^{57}Fe$ reactions, are described. The results are then briefly summarized. (JSR)

Properties of Radioactive Materials

Refer also to abstracts 31543, 31550, 31584, 31610, 31611, 31913, 32061, 32644, 32797, 32956, and 34471.

31664 (AED-CONF-73-180-001) SYNTHESIS AND PROPERTIES OF TRANSPLUTONIUM ELEMENTS. Mueller, W. (Commission of the European Communities, Karlsruhe (F. R. Germany). European Inst. for Transuranium Elements). 1973. 15p. (In German). (CONF-730370-1).

From meeting of the Gesellschaft Deutscher Chemiker; Regensburg, F. R. Germany (26 Mar 1973).

A review is given of the synthesis of transplutonium elements, discussing both the slower production process in a nuclear reactor and the rapid build-up in nuclear explosions and in stellar systems as well as ion bombardment (transactinides, super-elements), the chemical and nuclear properties of transplutonium elements and their classification in the periodic system and problems arising in the handling of these elements, preparative transplutonium chemistry (micro and macro techniques, americium metal), and the thermodynamic properties of these actinide metals and their interrelations. (GE)

31665 (ANL-8098) CHEMISTRY OF URANIUM IN NONAQUEOUS SOLUTION. Gindler, J. E. (Argonne National Lab., Ill. (USA)). Apr 1974. Contract W-31-109-eng-38. 34p. Dep. NTIS $4.00.

This report reviews the chemistry of uranium in nonaqueous solution, exclusive of molten-salt solution. Chapters are included for the various oxidation states of uranium(III, IV, V, and VI). The last chapter treats separately the behavior of U(VI) in different types of extractants: ethers, ketones, and alcohols; organophosphorus compounds; long-chain amines; and chelating agents in organic diluents. (auth)

31666 (IEA-318) PREPARATION OF UO_2 APPROPRIATE FOR CONVERSION TO UF_4. Ribas, A. G. S.; Abrao, A. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Nov 1973. 66p. (In Portuguese). Dep. NTIS (US Sales Only) $6.50.

A study of preparation, at laboratory scale, of UO_2 appropriate for conversion to UF_4, from ammonium diuranate, using NH_3 as the reducing agent is described. The experimental parameters studied were the following: temperature and time of ADU decomposition, heating rate, temperature and time of reduction, NH_3 excess and flow rate. The best operation conditions were fixed as a function of the experimental parameters over the UO_2 characteristics, mainly O/U ratio and specific area, and associating these properties to the conversion yield to UF_4. (auth)

31667 (WASH-1332(74)(Vol.2), pp 825-854) DECOMMISSIONING OF THE SPECIAL METALLURGICAL BUILDING AT MOUND LABORATORY. Harris, W. R.; Kokenge, B. R.; Marsh, G. C. (Monsanto Research Corp., Miamisburg, OH). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

The Special Metallurgical Building at Mound Laboratory, a building of 18,515 ft^2 of floor space, was decommissioned. This decommissioned facility formerly housed ^{238}Pu processes for the fabrication of radioisotopic fueled heat sources. The ^{238}Pu work was conducted in 585 linear ft of gloveboxes occupying approximately 12,600 ft^2 of the building. All of the gloveboxes, process services, building services, interior walls, and ceilings were removed to the point of exit at the roof. Eighty-five percent of the filter banks occupying 700 ft^2 of floor space was also removed. Special procedures and special equipment were used to reduce the amount of ^{238}Pu in the building from approximately 100,000 Ci at the start of the effort to less than 0.3 Ci without a significant release to the environment. (auth)

31668 CRYSTAL STRUCTURE OF URANIUM SULFOTELLURIDE UTeS. Rodier, N.; Nicolas, F. (Paris Univ., Chatenay-Malabry, France). Bull. Soc. Fr. Miner. Crist.; 96: No. 6, 356-358(Nov 1973). (In French).

UTeS crystallizes in the orthorhombic system with parameters $a = 7.66 \pm 0.01$ A, $b = 4.27 \pm 0.01$ A, $c = 8.84 \pm 0.01$ A. There are four formula units per unit cell. The atoms are in 4c positions of space group Pnma. The crystal structure has been determined from single-crystal x-ray diffraction data. The positions of atoms are given with the accuracy defined by $R = 0.06$. The structure of UTeS is closely related to that of $PbCl_2$. (FR)

31669 ELECTRONIC AND VIBRATIONAL SPECTROSCOPY OF URANIUM(IV) BOROHYDRIDE. Keiderling, T. A. Princeton, NJ; Princeton Univ. (1974). 235p. University Microfilms Order No. 74-17,465.

Thesis (Ph. D.).

The spectral and structural properties of uranium borohydride, $U(BH_4)_4$, and other $M(BH_4)_4$ molecules are discussed. These were first seen as model inorganic molecular crystals which offer higher symmetry, more accessible electronic states, and a wider variety of crystal structures than do the more studied organic molecular crystals. In addition to this interest, $U(BH_4)_4$ was seen as a possible system for studying covalency effects in actinide spectra and as an optical probe of metal borohydride bonding and structure. Principle spectral studies were done on $U(BH_4)_4$ [$U(BD_4)_4$] as a guest in $Hf(BH_4)_4$ [$Hf(BD_4)_4$ host crystals. In this environment $U(BH_4)_4$ adopts the full T_d symmetry of the host even at low temperatures. Optical spectra, from the charge transfer cutoff at ~2900Å to the low energy limit due to interference from host molecular vibrations at ~2.0 μ have been obtained at 300, 77, and 2K. These are interpreted and assigned as due to U^{+4}, $(5f)^2$, f-f transitions. From temperature effects, deuteration shifts, and intensity patterns, over 20 possible electronic origins have been identified. Several molecular vibrations have been identified built on these origins and, based on physically reasonable arguments, are tentatively associated with specific vibrational modes of $M(BH_4)_4$ type molecules. Attempts and failure to observe EPR spectra in this system are discussed. Zeeman effect experiments are also described. The results of both EPR and Zeeman experiments are used to deduce that the ground electronic state of cubic $U(BH_4)_4$ is of E symmetry being mostly $^3H_4$ in character. Excited states of cubic $U(BD_4)_4$ [$U(BH_4)_4$] have been assigned via a least squares fit of the electronic origins to the eigenvalues of a parameterized Hamiltonian. In this calculation, crystal field, spin-orbit and electron repulsion matrix elements must be simultaneously diagonalized because of their comparable sizes in +4 actinides. Most of the visible and near infrared absorption spectra of both $U(BH_4)_4/Hf(BH_4)_4$ and $U(BD_4)_4/Hf(BD_4)_4$ have been accounted for in this manner. Further efforts were made to include configuration interaction in this fitting process. The results are discussed and compared to calculations done herein on the previously published Cs_2UCl_6 assignments. Attempts to observe emission in the visible and near infrared are discussed as are attempted Stark experiments. Gas phase spectra successfully obtained in the visible and gas phase and mixed crystal spectra in the ultraviolet region show sizable gas-to-mixed-crystal red shifts. Other qualitative observations on $U(BH_4)_4$ spectra and metal borohydride chemistry are also discussed. Additional preliminary studies are reported for the absorption spectra of pure $U(BH_4)_4$ and $U(BD_4)_4$ crystals from 4000 to 20000 cm^{-1}. Methods for growing thin crystals are detailed, and attempts to obtain polarization data are discussed. Although a complete analysis was not possible, a qualitative interpretation is suggested. In an effort to obtain a better understanding of $U(BD_4)_4$ vibronic spectra, an analysis was made of $Hf(BH_4)_4$ and

$Hf(BD_4)_4$ vibrational spectra. Complete Raman spectra were obtained, and infrared spectra were taken from 600 to 200 cm^{-1} as an extension of published data. These spectra are assigned based on polarizations (Raman) and intensities to most of the experimentally accessible vibrational fundamentals. Symmetry coordinates for $M(BH_4)_4$ type molecules are constructed and a normal coordinate analysis attempted. Results of these calculations are discussed in light of their relationship to $U(BD_4)_4$/ $Hf(BD_4)_4$ vibronic spectra. Finally, appendices are presented which describe neutron diffraction determined crystal structures for $U(BH_4)_4$ and $HF(BH_4)_4$ and detail calculational methods used to assign the $U(BD_4)_4/Hf(BD_4)_4$ electronic origins. (auth)

31670 SOME REACTIONS OF URANIUM HEXACHLORIDE. A Contribution to the Chemistry of Uranium in the Oxidation States V and VI. Kolitsch, W. Marburg, Ger.; Marburg Univ. (1974). 123p. (In German). INIS.

Thesis. 16 figs.; 23 tabs.; 76 refs. With abstract. Available from the Marburg Univ. library.

The reaction behavior of uranium hexachloride was studied. It is extremely difficult to carry out reactions without reducing uranium hexachloride, which is a strong oxidizing agent. The compounds obtained having an oxidation state(VI) are distinguished by their extreme instability. Generally compounds of uranium(V) were obtained, namely hexachlorouranate(V) or uranium pentachloride. The latter was obtained in a triclinic modification, which was crystallographically investigated. An attempt was also made to determine the crystalline structure by x-ray analysis of $[C(N_3)_3]UCl_6$ obtained from reacting UCl_6 with ClN_3 in CCl_4. The intermediate stages of some reaction processes could be explained with the help of oscillation spectroscopy. The isolated compounds could be oscillation spectroscopically assigned. (GE)

31671 DEVELOPMENT OF RAPID SYNTHESES FOR THE CARBON-11 LABELLING OF AMINO ACIDS AND ALCOHOLS. Weimer, K. Darmstadt, Ger.; Technische Univ. (1973). 4p. (In German). INIS.

Thesis. Available from the library of the Technische Univ. Darmstadt. Summary form only.

Starting with simple ^{11}C-compounds (e.g., methane-^{11}C, $^{11}CO_2$) recoil chemically produced by proton or photon reactions, the following amino acids and fatty alcohols were produced with suitable inactive intermediary steps: aspartic acid-4-^{11}C; β-alanine-3-^{11}C; p-cyanophenyl alanine ^{11}CN; hexadecanol-1-^{11}C, and asparagine. Finally, only a mixture of asparagine and aspartic acid was obtained. Due to the short half-life of ^{11}C (20.3 min) which is used for nuclear medical applications, it very much depends on an optimization of the reaction times and yields of the individual synthesis steps. The labelled compounds were intended to be used for the determination of the ^{11}C distribution in organs in animal experiments carried out in cooperation with physicians. (GE)

31672 REACTION OF URANYL CHROMATE WITH SOME NEUTRAL LIGANDS. Shchelokov, R. N.; Orlova, I. M.; Podnebesnova, G. V. Zh. Neorg. Khim; 19: No. 6, 1581-1586(Jun 1974). (In Russian).

It was found that the interaction of uranyl chromate hydrate with neutral ligands leads to the formation of complexes of the composition $[UO_2(CrO_4)L_2]$, where L is urea, acetamide, dimethyl formamide, and $[UO_2(CrO_4)(OCN_2(CH_3)_4)]$. The polymer character of the compounds synthesized was established. (tr-auth)

31673 RADIOACTIVE DECONTAMINATION OF MEDICAL SUPPLIES UNDER FIELD CONDITIONS. Pejuskovic, B. Vojnosanit. Pregl.; 30: No. 4, 254-257(1973). (Serbo-Croatian).

Radioactive dust was 92.9 to 97.9% removed from bandaging materials and 95.5 to 99.1% removed from drug containers, and from medical instruments in amounts depending on the method, e.g., 93 to 98.5% by the use of cleaning powders, 76.8 to 98.1% by the use of detergent solutions, and 50.7 to 98.5% by the use of 3% citric acid. Data are tabulated for different types of bandages, drug containers, and instruments. (TTT)

31674 GAS-SOLID TYPE KINETICS OF REACTION BETWEEN URANIUM DIOXIDE AND HYDROGEN FLUORIDE. Jovanovic, D.; Milosavljevic, J. Tehnika (Belgrade); 27: No. 3, 69-74(1973). (In Slovak).

Investigations were made on the process of hydrofluorination of uranium dioxide in an atmosphere of gaseous anhydrous hydrofluoric acid by use of the thermogravimetric method. Experimental results were processed by use of mathematical kinetic expressions for gas-solid reactions. (Bull. Sci., Sect. A)

31675 Np(VII) IONS IN AQUEOUS ACID SOLUTIONS. Musikas, C.; Couffin, F.; Marteau, M. (CEN, Fontenay-aux-Roses, France). J. Chim. Phys.; 71: No. 5, 641-648(May 1974). (In French).

The normal potential of the couple Np(VII)-Np(VI) has been measured at various pH in acid media. Its value is approximately +2.04 at pH 0. It has been found that in acid media Np(VII) ions exist as NpO_3^+ ions and not as NpO_2^{2+} ions. At 20°C and for an ionic strength of 1, the solubility product for Np(VII) hydroxide (NpO_3OH) is 10^{-14}. Two sulfuric complexes of Np(VII) ions: $NpO_3(SO_4)^-$ and $NpO_3(SO_4)_2^{3-}$ have been found and their stability constants (5.6 and 58.2) show that they are less stable than the corresponding complexes of NpO_2^{++} ions. (FR)

31676 HYDRATED URANATES DON'T CONSTITUTE A CONTINUOUS SERIES. Noe-Spirlet, M. R.; Sobry, R. (Liege Univ.). Bull. Soc. Roy. Sci. Liege; 63: No. 3-4, 164-171(1974). (In French).

The method of Stuart and Whateley was applied for the preparation of hydrated lead uranates. It yielded a mixture of several stable compounds, which were identified by radiocrystallography. The examination of 36 samples confirms the existence of synthetic compounds analogous to fourmarierite and mysuyite, and also the existence of $PbO \cdot 6UO_3 \cdot 10H_2O$. Infrared spectroscopy supports these results and leads to the identification of the compound: $PbO \cdot 4UO_3 \cdot 6H_2O$. When heating the solutions in the course of preparation, the presence of $UO_3 \cdot 0.75\ H_2O$ was determined in the resulting mixtures. Results from the study indicate that lead uranates only exist for some well defined U/Pb compositions and, on the other hand, that the replacement of oxonium and hydroxyl ions induces a sharp modification of the structure. (auth)

31677 CHEMICAL REACTIONS OF NEPTUNIUM COMPOUNDS IN THE FUSED LiCl-KCl EUTECTIC. Lysy, R.; Landresse, G.; Duyckaerts, G. (Liege Univ.). Bull. Soc. Chim. Belg.; 83: No. 7-8, 227-233(1974). (In French).

Visible and near IR absorption spectrophotometry provides a good method for the study of chemical reactions in fused salts. It has been applied in the case of neptunium, whose chemical properties in a LiCl-KCl eutectic between 400° and 600°C have been investigated. (auth)

31678 HEXAMOLYBDATES OF THE RARE ELEMENTS. Gokhman, L. Z.; Lysanova, G. V.; Dublin, D. A.; Pashkova, A. V. (Inst. of General and Inorganic Chemistry, Moscow). Zh. Neorg. Khim.; 19: No. 8, 2018-2022(Aug 1974). (In Russian).

By solid phase interaction of the rare earth oxides with MoO_3 the hexamolybdates of the rare earth elements from Pr to Gd were obtained. The hexamolybdates of Nd, Gd, and Tb were obtained in the crystalline form growing from the melt. By the methods of differential thermal analysis, x-ray phase analysis, and IR spectroscopy, the behavior of these compounds during heating was determined. It was shown that during heating up to 550°C the hexamolybdates were decomposed into MoO_3 and tetramolybdates, and the latter during extended heating (660 to 720°C) again react with the formation of the hexamolybdates; water entering into the composition of the hexamolybdates has a zeolite character. (tr-auth)

31679 INFRARED SPECTROSCOPIC STUDIES OF THE SURFACE BOND OF CARBON DIOXIDE ON URANIUM OXIDES. Colmenares, C. (Univ. of California, Livermore). J. Phys. Chem.; 78: No. 21, 2117-2122(10 Oct 1974).

Infrared spectra of chemisorbed and adsorbed CO_2 on uranium oxide films were measured using transmission techniques. $UO_{2.18 \pm 0.02}$ bands at 1540 and from 1370 to 1380 cm^{-1} and shoulders at 1300 and 1600 cm^{-1} were interpreted as produced by strongly chemisorbed carboxylate species, CO_2^-. A broad band in the 3200 to 3600 cm^{-1} region and a broad shoulder in the 620 to 710-cm^{-1} region suggested the presence of physically adsorbed species. For $UO_{2.00 \pm 0.05}$ a single band at 845 cm^{-1} was observed after oxidation of the uranium films and also after exposure to CO_2. This band was interpreted to correspond to the optical phonon frequency for n-type stoichiometric, or slightly substoichiometric, uranium dioxide. (auth)

31680 COMPARISON OF THE POLYNUCLEAR ION, $[(UO_2)_2F_7]^{3-}$, WITH THE BINUCLEAR IONS: $[(UO_2)_2F_8]^{4-}$ AND $[(UO_2)_2F_9]^{5-}$. Nguyen Quy Dao; Chourou, S. (Ecole Centrale des Arts et Manufactures, Chatenay-Malabry, France). Compt. Rend., Ser. C; 278: No. 12, 879-881(18 Mar 1974). (In French).

X-ray diffraction analysis of a $K_3(UO_2)_2F_7 \cdot 2H_2O$ monocrystal revealed its structure to be in the form of a polynuclear ion chain having links which can be considered to have a $[(UO_2)_2F_6 \cdot F_{1/2}]^{3-}$ formula. [FR]

31681 EXCITON-PHONON INTERACTION IN CRYSTALS OF URANYL COMPOUNDS. Volod'ko, L. V.; Sevchenko, A. N.; Komyak, A. I.; Umreiko, D. S. (Belorussian State Univ., Minsk). Dokl. Akad. Nauk BSSR; 18: No. 7, 601-603(Jul 1974). (In Russian).

The low temperature (T = 293 to 4.2°K) polarization fluorescence and absorption spectra of crystals of the uranyl chlorides of Cs, Rb, and NH_4 was studied. The participation of the exciton-phonon interaction in the broadening of the spectral lines was examined. The nature of the exciton state in crystals of uranyl compounds is discussed. It was shown that the electron-oscillation transitions in the spectra at low temperatures can be attributed to the localized excitation with weak exciton-phonon bonds. The oriented gas model was applied to the description of these states. (tr-auth)

31682 PLUTONIUM. A General Survey. Taube, M. Kernchemie in Einzeldarstellungen, Volume 4. Weinheim, Ger.; Verlag Chemie GmbH (1974). 251p. DM 88,-.

The book contains chapters on the following: nuclear properties of plutonium; fission of plutonium isotopes; chemical properties of plutonium in solution and in the solid and molten state; problems of plutonium analysis; physiological effects of plutonium; breeding of nuclear fuel; plutonium as nuclear fuel; non-fuel applications of plutonium; plutonium fuel fabrication; irradiated plutonium fuel; technology of plutonium recovery; economics; a brief history of plutonium; and plutonium in scientific literature. (LK)

31683 MAGNETIC SCREENING ANISOTROPY OF THE ^{19}F NUCLEUS IN POTASSIUM PENTAFLUORORANYLATE. Matsutsin, A. A.; Gabuda, S. P.; Davidovich, R. L. (Inst. of Chemistry, Vladivostok, USSR). J. Struct. Chem. (USSR) (Engl. Transl.); 15: No. 2, 214-218(1974).

Translated from Zh. Strukt. Khim.; 15: No. 2, 233-237(1974).

It is shown that in the reorientation of ions around the symmetry axis of the n-th order ($n \geq 3$) inversion of the magnetic screening anisotropy of the nucleus is observed, which consists in a change in sign of the largest component of the screening tensor. Three independent tensor components for screening of the ^{19}F nucleus in $K_3UO_2F_5$ have been found, which enable the NMR absorption spectra to be calculated. (auth)

31684 RADIOIODINATION OF RIBOPOLYMERS FOR USE IN HYBRIDIZATIONAL AND MOLECULAR ANALYSES. Scherberg, N. H.; Refetoff, S. (Univ. of Chicago). J. Biol. Chem.; 249: No. 7, 2143-2150(10 Apr 1974).

Procedures were developed for the preparation of radioiodinated RNA suitable for molecular characterization and hybridization. Incorporation of radioiodine into RNA in a thallic trichloride-catalyzed reaction is strongly pH-dependent. Above neutral pH little uptake of isotope into polynucleotide occurs, although incorporation into protein proceeds rapidly. The initial linkage of iodine incorporated into RNA at pH 5 is unstable and as much as 70% of the iodine originally associated with the polynucleotide can be dissociated by further heating above neutral pH. The procedure for radioiodination and purification of the reaction product was developed to allow experimentation with nucleic acids that are available in only small quantities. These substances can be eliminated from high molecular weight RNA by including a filtration step and sedimentation through cesium sulfate in the post-labeling workup of the iodinated RNA. The new procedures decreased the background level in hybridization reactions to 0.01%. In addition to the base composition of RNA, results suggest that secondary molecular structure of RNA may be important to the extent of reaction with iodine. This latter factor must be taken into consideration for interpretation of experiments comparing profiles of iodine-labeled nucleic acids. In the same regard, the results show that reaction conditions yielding highly labeled RNA do not cause chain breakages. (auth)

31685 CHALCOGENIDES OF MOLYBDENUM, TUNGSTEN, TECHNETIUM, AND RHENIUM. Wildervanck, J. C. Groningen, Netherlands; State Univ. of Groningen (1970). 85p. University Microfilms Order No. 73-31,311. (In Dutch).

Thesis (Ph. D.).

The chalcogenides (sulfides, selenides, and tellurides) of molybdenum, tungsten, technetium, and rhenium were investigated. The methods of synthesis, the crystallization, the structures, and some properties of these compounds are described. A short survey was made of the chalcogenides mentioned and of some applications of the sulfides. The method of crystal growth by chemical transport reactions is discussed in some detail; apparatus for differential thermal analysis, built at this laboratory, is described and some problems are discussed. The preparation of MoS_3, WS_3, and Re_2S_7 from solution is described and the variable composition of these "higher sulfides" is discussed. The existence of crystalline forms of these sulfides could not be confirmed. The thermal decomposition of the higher sulphides was studied by D. T. A., T. G. A., and infrared spectroscopy. Decomposition with loss of sulfur takes place above about 200°C. At about 400°C an exothermic effect in D. T. A. shows the formation of phases $M_{1-x}S_2$, which gradually lose more sulfur at higher temperatures. Well-crystallized products of composition MS_2 are only obtained after long tempering at high temperatures. The dichalcogenides of Mo, W, Tc, and Re are considered and after some general remarks on layer-type structures, several methods of preparation and the synthesis of single crystals are described. The structures of two modifications of the disulphides and diselenides of Mo and W (a hexagonal one and a rhombohedral one) are described and the relation between these two modifications is discussed. The structures of the dichalcogenides of Re and Tc are also discussed. Triclinic unit cells for ReS_2 and ReSSe could be determined in analogy with that of $ReSe_2$. In contrast with the corresponding Mo and W disulfides and diselenides, in which the metal is trigonal-prismatically coordinated by chalcogen, ReS_2 and $ReSe_2$ have layer structures in which the cations are surrounded by six chalcogen atoms at the corners of a somewhat distorted octahedron; the cations are shifted towards one face of the octahedron giving rise to metal–metal bonds. The unit cells of TcS_2, $TcSe_2$, and $TcTe_2$ were determined by single-crystal x-ray diffraction methods and refined from powder data. TcS_2 and $TcSe_2$ also possess triclinic symmetry; their structure seems related to that of $ReSe_2$. $TcTe_2$ crystallized in a layer-type structure of monoclinic symmetry. The optical band gaps of the disulfides and diselenides of Mo, W, Tc, and Re were determined using single crystals. The crystallization of the of the disulfides, formed by thermal decomposition of the higher sulfides or the corresponding tetrathiometalates was studied by D. T. A. and x-ray diffraction. For MoS_2 and WS_2 a model for the crystallization is proposed in which the plate-like crystallites of composition $Mo_{1-x}S_2$ and one slab thick, have such a shape that a minimum proportion of Mo–S bonds are broken. This model links the particle size with the composition. The model was checked by chemical analysis and by determination of the particle size from the line-width of some reflections (hko) in powder diffractograms. The process of crystallization is described and illustrated. The formation of the metastable rhombohedral modifications of MoS_2 and WS_2 in carbonate fluxes is explained by the growth of the original crystallites (which are one slab thick) via a simple screw dislocation. (Diss. Abstr. Int., B)

Radioactive Waste Treatment

Refer also to abstracts 31547, 31551, 32020, 32045, 32949, 34215, 34308, and 34309.

31686 (AED-CONF-73-223-005) NEW TECHNIQUES FOR RADIOACTIVE WASTE PROCESSING IN NUCLEAR POWER PLANTS. Friedrich, R. 1973. 1p. (In German). (CONF-730698-4).

From European meeting on chemical engineering and ACHEMA congress; Frankfurt am Main, F. R. Germany (20 Jun 1973).

31687 (AED-CONF-73-223-011) EMBEDDING OF DISSOLVED INDUSTRIAL POISONS AND OF ISOTOPIC WASTE IN BITUMEN. Magyar, M.; Mozes, G. 1973. 1p. (In German). (CONF-730698-7).

From European meeting on chemical engineering and ACHEMA congress; Frankfurt am Main, F. R. Germany (20 Jun 1973).

31688 (ARH-SA-193S) IMMOBILIZATION OF SPENT CLADDING HULLS BY CONVERSION TO SILICATE FORMS. Schulz, W. W.; Dressen, A. L. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). May 1974. 5p. (CONF-741017-11). Dep. NTIS $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

A process for converting both Zircaloy and stainless steel spent fuel cladding hulls to immobile silicate and/or aluminosilicate forms of low-water leachability was devised and partially demonstrated. The proposed immobilization scheme involves oxidation of hulls to oxides and subsequent high-temperature conversion of the oxides to silicate forms. Such a scheme might be conveniently close-coupled with a silicate glass-making process used to immobilize high-level Purex process liquid waste. The proposed two-step cladding immobilization process involves conversion of metallic hulls to oxides by treatment at 500 to 600°C with $HF-O_2$ mixtures and melting of the resulting oxides at 1200°C with mixtures of basalt, B_2O_3, and Na_2CO_3. (JGB)

31689 (ICP-1048) REMOVAL OF CESIUM AND STRONTIUM FROM FUEL STORAGE BASIN WATER. Wilding, M. W.; Rhodes, D. W. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs – Operations Office). Aug 1974. Contract AT(10-1)-1375. 23p. Dep. NTIS $4.00.

Spent fuel from nuclear reactors is stored underwater at the Idaho Chemical Processing Plant for cooling and shielding before processing. The fuel storage basin water becomes contaminated

with fission products, primarily cesium-137 and strontium-90, from fuel elements that "leak" and from cut pieces of fuel and miscellaneous scrap contained in cans, which are vented to release gases. This report describes laboratory research and plant-scale tests of candidate ion-exchange materials for removing cesium-137 and strontium-90 from the contaminated storage basin water, which contains moderate quantities of nonradioactive dissolved solids. Cesium-137 is removed by a zeolitic ion-exchange material; strontium-90 is removed by an organic ion-exchange resin. Operational experience with plant-size ion-exchange columns indicates that both cesium-137 and strontium-90 are removed effectively by ion exchange. (auth)

31690 (JUL-1061-DE) EXPERIMENTAL DETERMINATION OF THE EFFICIENCY OF AN ALLUVIAL FILTER DEVICE FOR THE TREATMENT OF RADIOACTIVE WASTE WATER. Dobrevsky, I.; Jablonski, W.; Mallek, H.; Stipanits, P.; Zaddach, G.; Zange, E. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Abt. Dekontamination). Apr 1974. 11p. (In German). INIS.

7 figs.; 13 tabs.; 6 refs.

In the nuclear research center, Juelich, an alluvial filtering process was developed, which permits on the one hand an efficient removal of the mechanical impurities, on the other hand, an extensive decontamination of the water as well. The experiments that lead to the determination of the technological conditions for an effective alluvial filtration of active laundry and similar liquid effluents are described. It is shown that the costs of decontamination can be considerably reduced with this technology compared to the use of distillation and ion-exchange. The costs saving is 40 to 50% for the mentioned waste waters. (GE)

31691 (ORNL-tr-2855) ION-EXCHANGE RECOVERY OF TRANSURANIUM ELEMENTS IN THE EFFLUENTS OF AN IRRADIATED-FUEL PROCESSING PLANT. Arod, J.; Jourde, P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 – Saint-Paul-les-Durance (France)). 1972. Translated by Martha Gerrard from pp 1111-1131 Symposium on Management of Radioactive Wastes from Fuel Reprocessing, Paris, November 27 – December 1, 1972. (CONF-721107-7). 22p. Dep. NTIS $4.25.

From symposium on the management of radioactive wastes from fuel reprocessing; Paris, France (27 Nov 1972).

Recovery of the transuranium elements in three types of effluents from an irradiated-fuel processing plant was studied using ion exchange resins. With average effluent processing, some 90% of the transuranium elements present (Np, Pu, Am) could be recovered economically. An industrial unit with a nominal rate of 1 m^3/hr is now under study at Marcould. (auth)

31692 (WASH-1332(74)(Vol.1), pp 261-284) CATALYTIC OXIDATION AND OXIDE ABSORPTION FOR THE REMOVAL OF TRITIUM FROM AIR. Bixel, J. C.; Kershner, C. J. (Monsanto Research Corp., Miamisburg, OH). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

An apparatus and procedure were developed for studying the containment of tritium using catalytic conversion to the oxide followed by oxide adsorption. Data were obtained on the catalytic oxidation of elemental tritium and tritiated volatile hydrocarbons from pump oils between 23 and 538°C. Oxidation efficiencies as high as 99.99997% (decontamination factor = 3.3 million) were obtained for total tritium levels of 1 ppM and a tritiated hydrocarbon level of approximately 0.2 ppB. In addition, a mathematical study was made to derive equations for the conceptual design of an "Emergency Containment System" for containment of tritium following an accidental release to room air. (auth)

31693 (WASH-1332(74)(Vol.1), pp 285-320) NEW METHOD OF CONTROLLING RADIOACTIVITY IN LABORATORY WASTE WATER. Eno, E. (Univ. of California, Berkeley). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

A novel method of monitoring radioactive liquids wastes and controlling the release of radioactive water from active waste sewers is presented. This method, developed to handle large flows, costs less, requires less space, and is more effective than the conventional holding tank method. Advantages, equipment details, and experiences with the method are discussed. (auth)

31694 (WASH-1332(74)(Vol.1), pp 321-338) NEW PROCESS FOR REMOVING PLUTONIUM FROM WASTE WATER: A PROGRESS REPORT. Blane, D. E.; Schwind, R. A.; Kirby, H. W.; Murphy, E. L. (Monsanto Research Corp., Miamisburg, OH). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

A process is described that removes radionuclides (principally ^{238}Pu) from process water prior to discharge of the water. The contaminated water normally is in the pH range of 6 to 8. Under these conditions, Pu in all of its oxidation states is hydrolyzed and exists mostly in a colloidal or polymeric state. The level of radioactivity in the liquid stream entering the waste treatment facility averages about 25,000 dis/min/ml (11.3 μCi/l). The waste treatment process currently used has consistently reduced the radioactivity below the radioactive concentration guideline (RCG) of 11 dis/min/ml (5×10^{-3} μCi/l) for discharge to the river. However, the process under development has the added advantage of substantially reducing the volume of solid waste generated. Pilot plant tests show that a continuous fixed bed phosphate treatment of unprocessed influent waste water is feasible. However, a treatment of the influent water with ferric hydroxide and polyelectrolytes is necessary to remove colloidal or polymeric plutonium before contact with the bone char. (auth)

31695 (WASH-1332(74)(Vol.2), pp 1067-1088) TECHNIQUES AND FACILITIES FOR HANDLING AND PACKAGING TRITIATED LIQUID WASTES FOR BURIAL. Rhinehammer, T. B.; Mershad, E. A. (Monsanto Research Corp., Miamisburg, OH). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

Methods and facilities were developed for the collection, storage, measurement, assay, solidification, and packaging of tritiated liquid wastes (concentrations up to 5 Ci/ml) for disposal by land burial. Tritium losses to the environment from these operations are less than 1 ppM. All operations are performed in an inert gas-purged glovebox system vented to an effluent removal system, which permits nearly complete removal of tritium from the exhaust gases prior to their discharge to the environment. Waste oil and water from tritium processing areas are vacuum-transferred to glovebox storage tanks through double-walled lines. Accommodations are also available for emptying portable liquid waste containers and for removing tritiated water from molecular sieve beds with heat and vacuum. The tritium concentration of the collected liquids is measured by an in-line calorimeter. A low-volume metering pump is used to transfer liquids from holding tanks to heavy walled polyethylene drums filled with an absorbent or cement for solidification. Final packaging of the sealed polyethylene drums is in either an asphalt-filled combination 30- and 55-gallon metal drum package or a 30-gallon welded stainless steel container. (auth)

31696 STUDIES CONCERNING THE CRYSTALLIZATION OF BOROSILICATE GLASSES WITH RESPECT TO THE FIXATION OF RADIOACTIVE FISSION PRODUCTS. Heine, H. Berlin, Ger.; Technische Univ. (1973). 113p. (In German). INIS.

Thesis. 49 figs.; 20 tabs.; 52 refs. With abstract.

Two boron silicate glasses of different alkali content, which were derived from a vulcanic calcareous tufa, were used as matrix for the incorporation of fission product oxides. The dependence of crystallization on the content of fission product oxides was investigated as well as the time dependence of the amount and size of the crystals formed and the thus resulting changes of the short-term leaching and of the mechanical resistance. The temperatures of the largest rates of crystallization were determined by differential thermal analysis, and the crystallization products by X-ray diffraction analysis. Furthermore, pictures with the electron scan microscope and electron beam microprobe were used to examine the crystals (shape, size, composition). The results of the studies permits statements to be made as regards the use of the glasses in the fixation of radioactive wastes. (GE)

31697 BISORBENT M: A NEW TYPE OF SELECTIVE SORBENT. Isotopenpraxis; 10: No. 6, 236-238(Jun 1974). (In German).

The properties of Biosorbens M with respect to ion exchange, chelate formation, and sorption-coprecipitation processes are described. Its use for the decontamination of radioactive waste solutions in the processing of nuclear material and fuel element preparation, and the waste solutions contaminated by corrosion and fission products of nuclear power plants is briefly indicated. Typical sorption and elution curves for U and Ra are given. (JSR)

31698 OCHISTKA RADIOAKTIVNO-ZAGRYAZNENNYKH VOD. (Decontamination of Radioactively Contaminated Water of Laboratories and Research Reactors). Khonkevich, A. A. Moscow; Atomizdat (1974). 312p.

Decontamination of radioactively contaminated water obtained during the operation of radiochemical laboratories and research reactors is examined in detail. Methods for the decontamination of liquid wastes of low and average activity are described. The apparatus necessary for the decontamination and the technological plans of installations operating in the Soviet Union and other countries are also described. Questions connected with the technical and economic indicators of installations for the decontamination of water are examined. (tr-auth)

31699 OSNOVY OCHISTKI VODY OT RADIOAKTIVNYKH ZAGRYAZNENII. (Principles of the Purification of Water from Radioactive Contamination). Kuznetsov, Yu. V.; Shchebetkovskii, V. N.; Trusov, A. G. Moscow; Atomizdat (1974). 360p.

The scientific principles for the purification of drinking water from natural and artificial radioactive isotopes were examined for those cases where their concentration exceeds permissible levels. In addition to modern concepts on the behavior of microquantities of radioactive isotopes in water and different sorption systems, a description and evaluation of the efficiency of the purification of water by usual method of water treatment and by methods of chemical precipitation, ion exchange, electrodialysis, distillation, flotation, and biological purification was given. (tr-auth)

31700 ION-EXCHANGE PROPERTIES AND POSSIBLE APPLICATIONS OF WEATHERED ANTRIM BASALTS. Alexander, G. C.; Heal, H. G. (Queen's Univ., Belfast). J. Appl. Chem. Biotechnol.; 24: No. 7, 387-400(Jul 1974).

The composition and ion-exchange properties of weathered and hydrothermally altered Antrim basalts were examined. Lightly weathered olivine basalt contains large quantities of smectites with good cation-exchange capacity, adequate rates of exchange for practical applications, and useful selectivity. Much of the available basalt is suitable for direct use in ion-exchange beds after crushing and screening. Laboratory tests of possible applications are described; the most promising are the removal of cesium-137 from nuclear waste waters and of ammonia from treated sewage effluents. (auth)

Radioisotope Production

Refer also to abstracts 31581, 32568, 32643, and 33120.

31701 (AED-CONF-73-407-024) METHODS FOR THE IDENTIFICATION OF SHORT-LIVED TRANS-ACTINIDE ELEMENTS. Wolf, G. K.; Dreyer, J.; Roemer, J. (Heidelberg Univ. (F. R. Germany). Lehrstuhl fuer Radiochemie). 1973. 5p. (In German). (CONF-730927-6).

From 24th congress of the International Union of Pure and Applied Chemistry; Hamburg, F. R. Germany (3 Sep 1973).

The new generation of heavy-ion accelerators is likely to permit the production of transactinides in the near future. In order to be able to identify the elements 104 to 106 and 112 to 114, as well as to get information on their chemical properties, specific solid-state reactions have been worked out that can be performed in an accelerator beam. By using model reactions with homologues (Zr, Ga, Se) it could be shown that the recoils of the elements 104–106 and 112–114 produced in heavy-ion reactions will react with suitable solid-state scavengers to give volatile compounds that can be separated by evaporation. The reactions in question, the application tests (which are as close as possible to the conditions of practice), and the applied automatic devices are reported. (GE)

31702 (UCID-16113) OZONE: TAGGING FOR BIOMEDICAL PURPOSES. Meyer, P. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Jul 1972. 8p. Dep. NTIS $4.00.

The possibility of tagging ozone with ^{15}O was studied. The ^{15}O was obtained by a photonuclear reaction produced by bremsstrahlung from the 100-MeV Linac. The two reactions investigated were $^{16}O(\gamma,n)^{15}O$ and $^{20}Ne(\gamma,n\alpha)^{15}O$. Experimental results indicate that O_2 as a target gas provides sufficient amounts of tagged ozone to do useful studies in the range ≥ 0.05 ppM on an animal of a size suitable for the positron camera now operating at the Linac. (LK)

31703 DEVELOPMENT OF A HIGH-PRESSURE ION-EXCHANGE SYSTEM FOR RAPID PREPARATIVE SEPARATIONS OF TRANSURANIUM ELEMENTS. Specht, S.; Schuetz, B. O.; Born, H. J. (Technische Univ., Munich). J. Radioanal. Chem.; 21: No. 1, 167-176(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

In the course of ion-exchange separations of highly active solutions, the radiolysis gives rise to considerable disturbances and deteriorated separation results. On the example of $^{241}Am/^{242}Cm$ separations some results of radiolysis investigations for Dowex 50X8 are briefly shown, and experiences with the choice of parameters of a high-pressure column system are described for several examples. (auth)

31704 USE OF ALCOHOLIC SOLUTIONS FOR THE ISOLATION AND PURIFICATION OF AMERICIUM AND CURIUM WITH ANION-EXCHANGERS. Lebedev, I. A.; Myasoedov, B. F.; Guseva, L. I. (Inst. of Geochemistry and Analytical Chemistry, Moscow). J. Radioanal. Chem.; 21: No. 1, 259-266(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

The sorption of transplutonium (TPE), rare-earth (RE) and other elements by anion-exchangers (Dowex 1 type) from aqueous alcoholic solutions of nitric acid and ammonium thiocyanate was investigated. This investigation allowed the development of simple and effective methods of americium–curium separation from irradiated plutonium. Plutonium, TPE (in a +3 oxidation state), and RE are firmly sorbed by the anion-exchanger from 1M HNO_3 in 90% alcohol; Fe, Al, and fission products Cs, Sr, Nb, Zr, and Ru pass through the column under these conditions. The RE separation from TPE is achieved by washing the column with 0.5M NH_4SCN in 80% alcohol. The column is then washed with 0.5M HNO_3 in 85% alcohol, and americium–curium separation proceeds. Use of this method for recovery of an irradiated plutonium target containing 100 mg Pu, Am, and Cm is described. (auth)

31705 METHOD OF RADIOISOTOPE ISOLATION FROM CYCLOTRON TARGETS. Sevastianov, Yu. G. (Physico-Energetics Inst., Obninsk, USSR). J. Radioanal. Chem.; 21: No. 1, 247-257 (1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

The extraction of titanium and rhenium by oxygen-containing solvents (alcohols, ketones) was investigated. The investigations on the titanium extraction were carried out from hydrochloric acid solutions, on the rhenium extraction from alkaline solutions. The adsorption of cobalt and zinc on a strongly basic anion exchanger was determined from the MCl_2–HCl–LiCl (M = Ni, Cu) and $GaCl_3$–HCl solutions. On the basis of the results obtained, methods for the isolation of radioactive isotopes ^{44}Ti, $^{56,58}Co$, $^{65,69m}Zn$, and $^{183,184}Re$ from irradiated mixtures were elaborated. Technical characteristics of the isolated cyclotron-produced isotopes are presented. (auth)

31706 RAPID SEPARATION OF CARRIER-FREE INORGANIC AND ORGANIC COMPOUNDS OF RADIOIODINE AND ASTATINE BY HIGH-PRESSURE LIQUID CHROMATOGRAPHY. Roessler, K.; Tornau, W.; Stoecklin, G. (Kernforschungsanlage, Juelich, Ger.). J. Radioanal. Chem.; 21: No. 1, 199-209(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

The radioisotopes ^{123}I (T = 13.3 h) and, potentially, ^{211}At (T = 7.2 h) find increasing interest for radiopharmaceutical applications in diagnosis and therapy. They were produced via the $^{122}Te(\alpha,3n)^{123}Xe(\beta^+)^{123}I$ and the $^{209}Bi(\alpha,2n)^{211}At$ processes. Fast and efficient separations of carrier-free species obtained from target processing, as well as from classical or decay-induced synthesis were achieved by means of high-pressure ion-exchange and partition chromatography. Inorganic forms (X^-, XO_3^-, At^+) could be identified and separated on pretreated Aminex A 27 and A 7 resins, and biomolecules such as 5-halodeoxyuridines and -uracils on Aminex A 25 resins and Merckosorb Si 60 silica. The chromatographic methods can also be used for stability tests of radiopharmaceuticals in biochemical mixtures, notably physiological fluids. (auth)

31707 GENERATOR FOR PREPARATION OF CARRIER-FREE ^{224}Ra. Sebesta, F.; Stary, J. (Technical Univ., Prague). J. Radioanal. Chem.; 21: No. 1, 151-155(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

The construction of a dynamic generator for the separation of carrier-free ^{224}Ra is described. The mother ^{228}Th was extracted on the top of the column with di-(2-ethylhexyl)phosphoric acid on hydrophobized Chromosorb W DMCS. The function of the generator was checked during 6 months by measuring the decontamination of ^{224}Ra from ^{228}Th. Simultaneously the yield of ^{224}Ra was determined as a function of the HCl concentration and of the means of milking. The best results were obtained with 0.01–0.1M HCl; the yield was about 75% of the theoretical value, and the ^{224}Ra contained less than 0.01% of ^{228}Th. (auth)

31708 SEPARATION OF SOME CARRIER-FREE NUCLIDES FROM MATRICES BY CHELATE EXTRACTION. Lengyel, T.; Toerko, J. (Inst. of Isotopes, Budapest). J. Radioanal. Chem.; 21: No. 1, 81-85(1974).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

Separation procedures based on chelate extraction are described, which can be used in the course of production of carrier-free nuclides. The selectivities of the separations dealt with are fairly high, while the overall yield depends on the experimental conditions, primarily on whether the micro- or the macrocomponent of the system can be chelated. The problems encountered in the production of carrier-free ^{64}Cu, ^{67}Cu, ^{84}Rb, and ^{111}Ag are briefly discussed. (auth)

31709 PRODUCTION OF REFERENCE RADIOACTIVE GASES. Goenvec, H. (CEN de Saclay, Gif-sur-Yvette, France). pp 261-270 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974). (In French)

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

The development of nuclear power programs is leading to the construction of more and more reactors and fuel-processing plants of ever increasing size. It is therefore necessary to refine methods of estimating the amounts of radionuclides emitted during the operation of these installations. For this it is necessary to install a variety of carefully calibrated detectors. The only real way to achieving a precise calibration is to use standards of the same radionuclides as those contained in the effluents, in the same state and if possible in equivalent dilutions. The Ionizing Radiation Meteorology Laboratory has been producing three gaseous radionuclide standards for several years, namely ^{3}H, ^{85}Kr and ^{14}C; recently it has added ^{37}Ar and ^{133}Xe to that list. These five preparations are produced for calibrating ionization chambers, GM counters, and proportional counters. The activities supplied are approximately 1.5 μCi/ml s. t. p. and 3500 μCi/ml s. t. p. The measuring accuracy is approximately 3% and the radioactive purity is controlled. The gas is kept in glass ampoules, which is the most commonly used method. However, it does not meet the requirements of a new line of pollution investigations requiring the use of gas under pressure, to enable calibration to be carried out under circulation. Work is also in progress to produce the gases most frequently requested with activity levels and measuring accuracy corresponding to these requirements. (auth)

31710 CONTINUOUS RADIONUCLIDE GENERATION. I. Production and Evaluation of a ^{81m}Kr MINIGENERATOR. Colombetti, L. G.; Mayron, L. W.; Kaplan, E.; Barnes, W. E.; Friedman, A. M.; Gindler, J. E. (Veterans Administration Hospital, Hines, IL). J. Nucl. Med.; 15: No. 10, 868-873(Oct 1974).

An improved generator was devised as a prototype for clinical use which will provide continuous production of ^{81m}Kr. Delivery of ^{81m}Kr can be in liquid or gaseous state. Preparation of parent radionuclide and design of the generator and delivery system emphasizes a decreased contamination with the parent radionuclide and severe miniaturization of the generator and delivery system. Elution is by an injectable isotonic solution. (auth)

31711 DETERMINATION OF IMPURITY ACTIVITIES IN FISSION-PRODUCT GENERATOR ELUATE. Anderson, D. W.; Raeside, D. E.; Ficken, V. J. (Univ. of Oklahoma, Oklahoma City). J. Nucl. Med.; 15: No. 10, 889-891(Oct 1974).

Impurity activities in the eluate from fission-product ^{99m}Tc generators were studied by taking pulse-height spectra with a Ge(Li) spectrometer. The impurities ^{99}Mo, ^{131}I, ^{132}I, and ^{133}I have been found in the eluate with activities in the microcurie and submicrocurie range. The measured contaminant activities per millicurie of ^{99m}Tc were variable but within safe limits except in a special circumstance when the ^{131}I activity was excessively large. (auth)

Reactor Fuel Reprocessing

Refer also to abstracts 31475, 31500-31502, 32022, and 34187.

31712 (DOCKET-50201-151) WEST VALLEY REPROCESSING PLANT. License Application, Environmental Report, Supplement 2. (Nuclear Fuel Services, Inc., Rockville, Md. (USA)). 13 Sep 1974. 57p. Dep. NTIS $6.00.

Supplement 2 is the response to questions forwarded to NFS by the USAEC letter dated June 21, 1974. Included in Supplement 2 are maps showing roads, villages, streams, and railroads to a 10-mile radius from the plant and a large-scale contour map showing the piezometric surface of the intermediate aquifier at the site. A key to vegetational areas of NFS, a list of common plants at NFS, species distribution of fishes in Buttermilk and Cattaraugus Creeks, a small mammal census and chemical effluents and their monitoring are also included. (LK)

31713 (DOCKET-50332-47) BARNWELL NUCLEAR FUEL PLANT. License Application, FSAR, Amendment 7. (Allied-Gulf Nuclear Services, Barnwell, S. C. (USA)). 10 Oct 1973. 13p. Dep. NTIS $4.00.

The purpose of Amendment 7 is to request conversion of the Construction Permit, as amended, to an Operating License pursuant to 10 CFR 50.30(d) and 50.55(d). (LK)

31714 (DP-1357) CALCULATION OF URANIUM INVENTORIES IN MIXER-SETTLERS DURING SOLVENT EXTRACTION WITH 7.5% TBP. Thompson, M. C.; Shankle, R. L. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Aug 1974. Contract AT(07-2)-1. 29p. Dep. NTIS $4.00.

The computer program TRANSIENTS was used to determine the total uranium inventory in each bank of mixer-settlers during solvent extraction processing of uranium fuels with 7.5% TBP in kerosene. The resulting data were used to derive general equations for calculating the total uranium inventory in the mixer-settler banks under various operating conditions. These equations can be used in conjunction with the enrichment of the fuel being processed to calculate the inventory of fissile ^{235}U in the banks and to establish nuclear safety controls. (auth)

31715 (DP-1361) PARTITIONING OF LIGHT LANTHANIDES FROM ACTINIDES BY SOLVENT EXTRACTION WITH TBP. McKibben, J. M.; Holcomb, H. P.; Orth, D. A.; Prout, W. E.; Scotten, W. C. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Aug 1974. Contract AT(07-2)-1. 26p. Dep. NTIS $4.00.

A solvent extraction process was developed for removing the light lanthanides (La, Ce, Pr, Nd) from americium-curium produced by neutron irradiation of ^{239}Pu. The light lanthanides are extracted into 30% TBP in normal paraffin hydrocarbon diluent from a lithium-nitrate-salted system containing diethylenetriaminepentaacetic acid (DTPA) to complex the actinides and render them less extractable. The actinides and any residual lanthanides remain in the aqueous raffinate. Maleic acid is used to control the acidity in extraction. The aqueous raffinate containing the actinides and residual lanthanides is further processed by solvent extraction with 30% TBP to remove interfering salts before the actinides are purified by chromatographic ion exchange. In pilot tests in miniature mixer-settlers, at least 98% of the lanthanum and 88% of the neodymium were rejected from irradiated plutonium. Recovery efficiency for americium and curium was >99%. (auth)

31716 (HW-18700) REDOX TECHNICAL MANUAL. Hanford Works, Richland, Wash. (USA)). 10 Jul 1951. Contract W-31-109-eng-52. 1027p. Dep. NTIS $53.50.

Declassified 3 Jun 1974.

The Redox Technical Manual is divided into five parts. Part I is a summary of general information on the plant and the process. Part II is a step-by-step description of the process including scientific and engineering principles involved. Part III describes the plant layout, equipment arrangement, and individual equipment pieces. Part IV describes the instruments and analytical methods used for process control, and Part V describes process hazards and the methods used to safeguard against them. (LK)

31717 (ICP-1047) IDAHO CHEMICAL PROGRAMS ANNUAL TECHNICAL REPORT, FISCAL YEAR 1973. Bower, J. R. (ed.). (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs-Operations Office). Jun 1974. Contract AT(10-1)-1365. 182p. Dep. NTIS $7.60.

The operating experience in fuel processing, waste calcining, and other waste management activities at the ICPP for FY 1973 is summarized. The first "hot" electrolytic dissolution campaign for EBR-II fuel elements proceeded smoothly, meeting and surpassing all goals. A coprocessing campaign for simultaneous recovery of uranium from zirconium- and aluminum-based fuels was successfully completed. Technical support activities in the areas of current and proposed operations at the ICPP are also presented. These include: improvements in operation of the solvent extraction system to minimize uranium losses and improve product purity; redesign and replacement of the zirconium dissolver; progress in design and development of processes for Rover and HTGR fuels, including successful pilot-plant-scale combustion and dissolution of Rover fuels; pilot-plant calcination of varied waste solutions; and progress in plans for new and improved facilities for handling and controlling gaseous, liquid,

and solid waste products with emphasis on environmental protection. Research programs in other areas include: catalytic reduction of NO_x to nitrogen using ammonia and zeolites; adsorption of methyl iodide from dilute gas streams using metal-exchanged zeolites; investigation of radioactive gaseous releases from nuclear power reactors; and continuation of the program for determining burnup in fast breeder reactor fuels. (auth)

31718 (INIS-mf-1365) PROCESS-CONTROL OF THORIUM ELEMENT REPROCESSING EXPERIMENT. Brodda, B.; Halling, H. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany)). [nd]. 3p. INIS.

From 1st international symposium on CAMAC in real-time computer applications; Luxembourg (4 Dec 1973).

A data acquisition and processing system was built to study the reprocessing of high-temperature-reactor fuel elements in a prototype industrial process loop. Besides acquiring data from the process and different measurement equipment, bookkeeping and storage-management of the hot samples was performed. An interactive communication network supports access to the bulk storage system for information retrieval and updating. (auth)

31719 (JUL-1016-HT) SYSTEM ANALYSIS OF THE STUDY FOR CLOSING THE HHT FUEL CYCLE. Kayser, J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Projekt Hochtemperaturreaktor mit Heliumturbinen). Nov 1973. 69p. (In German). INIS.

9 figs.; 14 refs.; 1 tab. With abstract.

Starting out from the market forecast for high-temperature reactors (HTR) in Europe, the time of beginning of operation and the capacity of the first large reprocessing and refabrication plant is optimized in as far as possible with the present state of technology. An optimum capacity was calculated sufficient to serve 50,000 MW(e)-HTR power. This plant should be in operation by 1989. To bridge the time gap until 1989, four variants are alternatively compared to partly close the fuel cycle. (GE)

31720 (ORNL-TM-4519) HTGR FUEL REPROCESSING: A WHOLE-BLOCK BURNER WITH RECYCLE OF COOLED GAS FOR TEMPERATURE CONTROL. Haas, P. A. (Oak Ridge National Lab., Tenn. (USA)). Aug 1974. Contract W-7405-eng-26. 44p. Dep. NTIS $5.45.

Burning of whole fuel blocks (hexagonal prisms about 14 in. across the flats and 31 in. long) is being investigated as one head-end treatment for reprocessing the General Atomic Company type of HTGR fuel. Experimental results with a one-sixth-block burner have shown practical burning rates and good utilization of O_2. This report describes and presents analyses for a whole-block burner with recycle of cooled gas to provide temperature control and heat removal. A simplified model was selected and computer programs were written to calculate gas compositions and temperatures throughout the burner. Complete utilization of O_2 or low concentrations of O_2 in the exit gas depend on graphite temperatures that are sufficiently high to produce CO, which reacts with O_2 in the bulk gas. It does not appear practical to operate under conditions that promote both high utilization of O_2 and low CO concentration in the exit gas. Instead, the burner conditions should be chosen to clearly favor moderate concentrations of either O_2 or CO in the exit gas. Moderate concentrations of O_2 in the exit gas would allow lower graphite temperatures and would probably give the desired burning rates for three axially aligned blocks. Moderate concentrations of CO in the exit gas would ensure high burner capacities but would result in higher temperatures and more complex burner control behavior. An experimental burner is recommended to verify the calculated results. The general conclusions apply to both fluidized- and fixed-bed burners. (auth)

31721 EXTRACTION CHROMATOGRAPHIC SEPARATION OF URANIUM, PLUTONIUM, AND FISSION PRODUCTS. Huebener, S.; Hermann, A. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). J. Radioanal. Chem.; 21: No. 1, 157-166(1974). (In German).

From 7th radiochemical conference; Marianske Lazne, Czechoslovakia (Apr 1973).

An extraction chromatographic method was developed to separate plutonium and uranium from irradiated uranium fuel samples. Tributyl phosphate fixed on polytetrafluoroethylene was used as stationary phase and HNO_3 of various concentrations as mobile phase. The separation of plutonium by reduction with H_2SO_3 was studied in column experiments. The method was applied to the separation of irradiated U/Mg-fuel with a Pu/U ratio of 1:400. (auth)

CONTROLLED THERMONUCLEAR RESEARCH

31722 TECHNOLOGY INDEX FOR PLASMAPHYSICS RESEARCH AND FUSION REACTORS. Volume 8, No. 8, 1974. Bibliography, Author Index, Subject Index, Appendix. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 45p.

31723 PLASMA PHYSICS INDEX. Volume 9, No. 8, 1974. Bibliography, Author Index, Subject Index. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 164p.

Confinement and Heating

Refer also to abstracts 31768 and 31844.

31724 (CONF-740402-P2, pp 36-44) METHODS OF DETERMINING ρR IN LASER FUSION EXPERIMENTS USING NEUTRON DIAGNOSTICS. Campbell, H. D.; Southworth, F. H. (Univ. of Florida, Gainesville). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

Derivations of two methods for determining the ρR parameter for a laser-induced fusioning plasma are presented. Each method is examined for differing models of plasma density history. (auth)

31725 (CONF-740402-P2, pp 63-74) SOME REACTOR CONCEPTS BASED ON THE LASER HEATED SOLENOID. Steinhauer, L. C.; Rose, P. H. (Mathematical Sciences Northwest, Inc., Seattle). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

A series of fusion reactor concepts is conceived within the scope of the basic laser heated solenoid approach. These concepts are examined in the light of an energy economy criterion and other factors and are offered as viable avenues for the early achievement of fusion power. (auth)

31726 (COO-3165-7) FUNDAMENTAL STUDIES OF TURBULENT AND RELATIVISTIC ELECTRON BEAM HEATING OF A PLASMA. Supplementary Progress Report, 1 April 1974–30 September 1974. Wharton, C. B. (Cornell Univ., Ithaca, N. Y. (USA). Lab. of Plasma Studies). 1974. Contract AT(11-1)-3165. 13p. Dep. NTIS $4.00.

Rapid heating of a collisionless plasma column by an intense relativistic electron beam was accomplished. Experiments were performed in the same apparatus as previous turbulent heating investigations, permitting a direct comparison, using established diagnostics. The magnetically confined plasma column was surrounded by hard vacuum. The chronology of the turbulent heating experiment is outlined. Some of the heating mechanisms of the relativistic electron beam are discussed. (MOW)

31727 (N-74-21334) PARAMETRIC STUDY OF ION HEATING IN A BURNOUT DEVICE (HIP-1). Sigman, D. R.; Reinmann, J. J.; Lauver, M. R. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Apr 1974. 19p. (NASA-TM-X-3033; E-7766). NTIS $3.00.

Results of further studies on the Lewis Research Center hot-ion plasma source (HIP-1) are reported. Changes were made in both the electrode geometry and materials to produce higher ion temperatures. Ion temperature increased significantly with increased vacuum pumping speed. The best ion temperatures achieved, so far, for H(+), D(+), and He(+) plasmas are estimated to be equal to, or greater than 0.6, equal to, or greater than 0.9, and equal to, greater than 2.0 keV, respectively. Electrode pairs produced high ion temperatures whether on the magnetic axis or off it by 5.5 cm. Multiple sources, one on-axis and one off-axis, were run simultaneously from a single power supply by using independent gas feed rates. A momentum analyzer was added to the charge-exchange neutral particle analyzer to identify particles according to mass, as well as energy. Under any given plasma condition, the higher mass ions have higher average energies but not by as much as the ratio of their respective masses. (auth)

31728 HIGH POWER NEUTRAL PARTICLE BEAMS FOR FUSION RESEARCH. Schilling, G. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). Kerntechnik; 16: No. 7, 309-313(Jul 1974). (In English, German).

6 figs.; 7 refs.

The principle and technical realization of plasma heating by neutral particle beam injection, especially the plasma source DuoPIGatron as well as the Garching test stand for injector development, are briefly discussed. (GE)

31729 EQUILIBRIUM OF A TOROIDAL PINCH IN A STATIC MAGNETIC FIELD AND IN A HIGH-FREQUENCY LARGE-AMPLITUDE FIELD. Gutkin, T. I.; Lozovskii, S. N. (Physical-Technical Inst., Sukhumi, USSR). Nucl. Fusion; 14: No. 4, 475-481(Sep 1974).

The equilibrium confinement of a toroidal plasma pinch in a static magnetic field and in a high-frequency large-amplitude field is considered in the general case where the gas-kinetic plasma pressure NT is comparable with the pressure of the high-frequency field $H^2/16\pi$. It is assumed that the high-frequency field in the range of frequencies 1 to 10 MHz has a helical or multipole configuration and is excited by given external high-frequency currents passing through the current sheath surrounding the pinch. At high amplitudes of the high-frequency field, it is necessary to allow for the effect of the toroidicity of the system on the equilibrium conditions. In a first approximation with respect to the small parameters Δ/r_p and r_p/R (Δ is the displacement, r_p is the radius of the pinch, R is the major radius of the torus) expressions are found for the high-frequency fields in a system with a displaced pinch and the condition for equilibrium of the pinch as a whole along the major radius is obtained. The equilibrium displacement of the pinch is determined from this condition, making use of the field values of the first approximation at the plasma boundary. It is shown that the use of high-frequency large-amplitude fields offers additional possibilities of controlling the equilibrium displacement. In particular, the effect of the toroidicity of the high-frequency field leads to the occurrence of an additional force, which in a number of cases causes the pinch to be displaced to the inner wall of the toroidal chamber. When $\tilde{\beta} = 16\pi NT/\tilde{H}^2 < 1$, it is also possible to have a paramagnetic effect when the pinch is forced out by a nonuniform static field towards the side where the intensity of the field is higher, i.e., to the inner wall of the torus. Under certain conditions the phenomena making positive or negative contributions to the equilibrium displacement of the pinch may be mutually compensating, so that the displacement can be made fairly small or even eliminated by suitable choice of the system parameters. The minimum displacement of the pinch for a given amplitude of the high-frequency current in the circuit practically always occurs in the case of quadrupole systems. It is shown that equilibrium confinement of plasma by high-frequency fields is also possible in systems where the plasma pinch is surrounded by a continuous conducting shell (so-called "high-frequency tokamak"). The theoretical results obtained are in agreement with the results of experimental investigations. (auth)

31730 COMPARISON BETWEEN LASERS AND RELATIVISTIC ELECTRON BEAMS FOR CONTROLLED FUSION. Bobin, J. L. (CEA de Limeil, Villeneuve Saint-Georges, France). Nucl. Fusion; 14: No. 4, 553-559(Sep 1974). (In French).

When concentrated on a solid surface, relativistic electron beams, like laser beams, generate a high-temperature dense plasma. The paper discusses how these two energy sources are compatible with the break-even requirements in systems where the spherical target is compressed, the parameters of comparison being the available energy and flux and the different yields characteristic of each system and of the beam plasma coupling. (auth)

31731 EFFECT OF ELECTRON BEAM PARAMETERS ON THE PROCESS OF ACCUMULATING HOT ELECTRONS IN A MIRROR TRAP. Zakatov, L. P.; Plakhov, A. G. Zashch. Pokrytiya Metal.; No. 4, 49-54(1974). (In Russian).

A study is presented on the mechanism of generating and accumulating hot electrons during the interaction of an electron beam with a cold plasma in a mirror machine. Measurements were made on the energy density distribution of the hot plasma component along the radius of the system, the time course of the diamagnetism and the leakage of fast electrons from near the beam region to the loss cone. It was established that there is a substantial difference in processes of accumulating hot electrons depending on whether the beam current or its energy is varied. It is concluded that under conditions of these experiments the hot plasma component is formed from the beam electrons. (SJR)

31732 DYNAMICS OF AN AXIALLY WALL-LIMITED THETA PINCH COMPRESSED BY A METALLIC LINER. Alikhanov, S. G.;

Konkashbaev, I. K. (Inst. of Atomic Energy, Moscow). Nucl. Fusion; 14: No. 3, 341-343(Jun 1974).

Axial plasma flows during compression of a limited theta pinch were determined. An approximate formula for the temperature dependence on the compression ratio is compared with the results of an exact numerical calculation. (auth)

31733 PROFILED CONCENTRIC SHOCK COMPRESSION OF A PLASMA BALL ON THE GROUNDS OF A SIMPLIFIED MODEL. Kaliski, S. (Inst. of Fundamental Technological Research, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 22: No. 5, 381-388(1974).

Using the method of a simplified averaged description of the compression of a plama ball, this problem was solved for profiled pressure pulse. The solution was obtained in quadratures. In addition to its direct applications, the present solution furnishes a point of departure for the construction of more general equations of profiled laser compression of plasma, taking into consideration the structure of shock-wave fronts (thermal) with simultaneous consideration of the processes of thermonuclear fusion. Generalization of this solution to nonhomogeneous bodies having prescribed nonhomogeneity profiles gives a possibility of the compression process being made isentropic. (auth)

31734 INJECTION OF A NEUTRAL PARTICLE BEAM INTO A TOKAMAK: EXPERIMENT AND THEORY. Cordey, J. G.; Hugill, J.; Paul, J. W. M.; Sheffield, P. J.; Seth, E.; Stott, P. E.; Tereshin, V. I. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). Nucl. Fusion; 14: No. 3, 441-444(Jun 1974).

A beam of neutral particles was injected into the CLEO Tokamak along a tangent to R = 0.79 m in a 25 ms pulse at peak current. Injection both parallel and anti-parallel to the toroidal current was achieved by reversing the current. With injection of hydrogen atoms the beam power reaching the plasma is typically 50 kW of which about 30 kW can be associated with ions on contained orbits for both current directions. The following topics are discussed: (1) gross characteristics with injection, (2) spectra of contained high-energy ions, (3) distortion of the thermal ion spectrum by injection, and (4) ion heating. (MOW)

Diagnostics

Refer also to abstracts 31724, 31892, and 32306.

31735 (CONF-730618-, pp 262-267) DYNAMIC SPECTROMETER FOR THE STUDY OF PLASMA BURSTS. Oron, M.; Paiss, Y. (Univ. of Rochester, NY). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Ions that are blown off plasma bursts have charge, mass, and energy distributions that are related to the plasma parameters and composition. The determination of these distributions is essential when plasma parameters and/or composition are studied. A dynamic spectrometer is described in which the yield and energy distributions are determined simultaneously for each plasma burst. The spectrometer described has a single spatial collection point for each (q/m) enabling the collection of the separated species or to make further use of a desired ion beam. (SW)

31736 (CONF-740402-P2, pp 45-52) NEUTRON DIAGNOSTICS FOR LASER-INDUCED FUSION. Southworth, F. H.; Campbell, H. D. (Univ. of Florida, Gainesville). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

Four methods of diagnosing the parameters, T_i and ρR, in a fusioning plasma by examining the emitted neutrons are presented. Each method requires only relative measurement of neutron yield. The estimated minimum neutron yield to employ each method is also calculated. (auth)

31737 MASS SPECTROMETRY INVESTIGATIONS ON PLASMA BOUNDARY LAYERS. Henrich, K. Bonn, Ger.; Bonn Univ. (1972). 64p. (In German). INIS.

Thesis. 38 figs.; 6 tabs.; 30 refs. With abstract. Available from the Bonn Univ. library.

A description is given of measurements with a mass spectrometer on the positive ions and neutral gas of argon plasmas at 0.1 to 0.6 torr. The coupling of the mass spectrometer to the plasma requires extraction probe and ion optics for imaging and bunching of the charge carrier flow toward the mass spectrometer entrance. Equations are given and numerical calculations are carried out for proper dimensioning of the ion optics and to describe the ion path. The systematical measurement of the energy distributions of the individual ion types show: (1) The BOHM criterion is confirmed. The ions are heated up to electron temperature in the transition zone of the boundary layer and are accelerated in the space-charge zone. (2) The heating-up and acceleration of the ions increases with the growing stream of ions to the extraction probe. (3) With a further increase of the probe currents, collisions start to occur in the space-charge zone of the boundary layer. According to measurements, Ar_2^+ collisions begin sooner than Ar^+ which is mainly present. This result implies a larger collision cross-section for the Ar_2^+ ions. (4) The H_3O^+ contained in small concentration in the plasma still cross the layer in this parameter range free of collision even at high ion accelerating voltages. (5) A simple measurement of the flow of an ion type in dependence of the probe current is well suitable as an experimental method of answering the question of whether these ions collide in the boundary layer. (GE)

31738 THE MEASUREMENT OF HOT PLASMA TEMPERATURES. Roehr, H. (Max/Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). Kerntechnik; 16: No. 7, 301-308(Jul 1974). (In English, German).

7 figs.; 15 refs.

Principal and technical realization of the measurement of hot plasma temperatures by laser light scattering are discussed. (GE)

31739 THOMSON SCATTERING PLASMA DIAGNOSTICS USING A FOUR PULSE RUBY LASER. Jones, P. A. (United Kingdom Atomic Energy Authority, Foulness, Eng.). J. Phys., E (London); 7: No. 9, 704-706(Sep 1974).

Four giant laser pulses, separately programmed and amplified, have been obtained from a single ruby oscillator/amplifier system. An array of totally internally reflecting prisms divided the main cavity into four sub-cavities, each of which was independently Q switched with a delay variable from 0 to 600 μs. The pulses produced by this system have been used to make more efficient Thomson scattering measurements on a pulsed laboratory plasma. (auth)

31740 PLASMA DIAGNOSIS WITH OPEN MICROWAVE RESONATORS. Stana, R. (Institutul de Fizica Atomica, Bucharest). Stud. Cercet. Fiz.; 25: No. 1, 119-129(1973). (In Rumanian).

The equations describing the behavior of a plasma in an open microwave generator are derived. The principles of the use of these generators in plasma diagnostics are outlined. The determination of the concentration and frequency of electron collisions, the anisotropy of the plasma, and density profiles can be made with the open microwave generator. (JSR)

31741 SENSITIVE METHOD FOR MEASURING A CONSTANT ATOMIC POPULATION BY OPTICAL ABSORPTION. Bruneteau, A. M. (Ecole Polytechnique, Paris). J. Phys., E (London); 7: No. 9, 738-740(Sep 1974). (In French).

A sensitive method for measuring atomic plasma density by optical absorption is described. It uses a null method with a synchronous detection by optical means which allows measurement of the even weak absorption of a steady-state or slowly varying population of particles. (auth)

31742 MEASUREMENT OF EXTREMAL VALUES AND INTEGRATION OF RAPIDLY VARYING IRREGULAR SIGNALS BY MEANS OF A PULSE-AMPLITUDE ANALYZER. Zhdanov, K. A.; Zatsepin, V. G.; Tishchenko, E. A. (Inst. of Physics Problems, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 1, 154-155(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 1, 138-140(1974).

An attachment was developed for a pulse-amplitude analyzer used in fast measurements of the minimal and maximal values of the coefficients of transmission and reflection of submillimeter radiation by a moving plasma pinch. The attachment performs amplitude modulation of an auxiliary pulse voltage by the investigated continuous electrical signal. After modulation the pulses are processed and memorized by the analyzer. (auth)

31743 RECORDING OF THE COORDINATES OF A MOVING PLASMA PINCH. Tishchenko, E. A.; Zatsepin, V. G.; Zhdanov, K. A. (Inst. of Physics Problems, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 1, 173-174(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 1, 153-155(1974).

A system is described which records the position of the axis of an irregularly moving plasma pinch in a microwave resonator. Using two pairs of photodiodes onto which the image of the pinch is projected in two mutually perpendicular directions, the instant of arrival of the pinch axis at a stipulated point in space is determined. The system is used to measure the transmission coefficient of submillimeter radiation by points for various impact parameters of the axis of the fixed probing beam relative to the axis of the moving plasma pinch. (auth)

31744 DETERMINATION OF ELECTRON TEMPERATURE IN A LORENTZ PLASMA BY SONIC PROBE. Saxena, A. P.; Saxena, R. K. (Government Coll. of Engineering and Tech., Raipur, India). Indian J. Pure Appl. Phys.; 12: No. 3, 198-201 (Mar 1974).

A comparative study of the two plasma diagnostic techniques, viz. the sonic probe and the double probe, was made under the same experimental conditions by determining the electron temperature in a weakly ionized plasma. It was found that there is fair agreement in the results obtained by the two methods. The sonic probe technique proves to be a very sensitive device for exploring weakly ionized plasma as compared to the double probe. (auth)

31745 MEASURING THE ELECTRON DISTRIBUTION FUNCTION OF A PLASMA BY THE MICROWAVE-PROBE METHOD. Gorozhanin, D. V.; Ivanov, B. I.; Miroshnichenko, V. A.; Prishchepov, V. P. (Physical-Technical Inst., Kharkov). Nucl. Fusion; 14: No. 4, 493-496(Sep 1974).

A method is described for measuring the longitudinal-velocity electron-distribution function based on microwave probing of the plasma in the region of the electron cyclotron resonance. Formulas are given relating the electron distribution function to the Doppler shape of the cyclotron absorption line of an electromagnetic wave in a plasma. The authors discuss the distribution function values measured in a beam–plasma discharge by probing the plasma with waves in the 8-mm range. (auth)

Kinetics (General)

31746 THE WALL-DETERMINED ANNIHILATION OF EXCITED ATOMS IN PLASMAS. Lenoir, W. Bonn, Ger.; Bonn Univ. (1972). 43p. (In German). INIS.

Thesis. 22 figs.; 2 tabs.; 43 refs. With abstract. Available from the library of Bonn Univ.

The wall-determined annihilation of excited atoms is experimentally and theoretically investigated, in particular the decay of the density of He–2^3S metastable states by the annihilation on the wall at different wall temperatures and at pressures of $10^{-2} < p < = 1$ torr. High reflectivities ($0.96 < \beta < 1$) and constant decay frequencies at low pressures as far as into the diffusion region are obtained. The decay frequencies are calculated from the diffusion equation, taking into account reflection, with the exact boundary condition being obtained from the microscopical description with the help of the distribution function. It is found that the usual boundary condition obtained up to now with reflection represents only a first approximation. (GE)

31747 MICROWAVE AND MASS SPECTROMETRIC STUDIES OF AFTERGLOW PROCESSES IN PLASMAS PRODUCED IN RARE GASES. Armour, D. G. (Univ. of Liverpool). J. Phys., B (London); 7: No. 10, 1213-1223(11 Jul 1974).

An experimental system comprising a conventional X-band cavity arrangement in conjunction with a quadrupole mass spectrometer has been developed to allow simultaneous measurement of the time-dependent number densities of electrons and positive ions in decaying rare gas plasmas. Studies in argon and krypton afterglows indicated that, in both gases, three different ion species were present immediately after switching off the plasma excitation. In argon, ions at m/e = 20, 40 and 80 amu, identified as Ar^{2+}, Ar^+ and Ar_2^+ respectively were detected and measurement of the decay time constants yielded reduced mobilities of $\mu_0(Ar^+) = 1.6 \pm 0.2$ cm^2 V^{-1}s^{-1} and $\mu_0(Ar_2^+) = 1.8 \pm 0.3$ cm^2 V^{-1}s^{-1}. The lifetime of the ion identified as Ar^{2+} was too short to allow accurate time resolved measurements to be carried out. In krypton, ions identified as Kr^{2+}, Kr^+ and Kr_2^+ were detected and reduced mobility values for the two singly charged ions of $\mu_0(Kr^+) = 0.8 \pm 0.2$ cm^2 V^{-1}s^{-1} and $\mu_0(Kr_2^+) = 0.9 \pm 0.2$ cm^2 V^{-1}s^{-1} deduced. A similar series of experiments in xenon, limited by the mass range capabilities of the mass spectrometer, yielded reduced mobilities of 0.6 ± 0.2 cm^2 V^{-1}s^{-1} and 0.8 ± 0.2 cm^2 V^{-1}s^{-1} for the singly charged atomic and molecular ions respectively. (auth)

Kinetics (Experimental)

31748 (UCID-16035) USE OF DIFFUSING INDUCTIVE FIELDS OF A RELATIVISTIC BEAM–PLASMA SYSTEM TO DETERMINE PLASMA CONDUCTIVITY. Lee, E. P.; Prono, D. S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Apr 1972. Contract W-7405-eng-48. 23p. Dep. NTIS $4.25.

The radial diffusion of fields induced by the discontinuity of a relativistic electron beam passing through a plasma is related to the conductivity. Solutions are obtained which give this relation and it is shown how a determination of the conductivity profile can be obtained by measuring the diffusing azimuthal magnetic fields. (auth)

Kinetics (Theoretical)

31749 (IPP-2/221) FREE-BOUNDARY HELICAL EQUILIBRIA. Barberio-Corsetti, P. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Apr 1974. 17p. INIS.

2 figs.; 12 refs. With abstract.

The MHD equilibria of helically symmetric, current-carrying plasmas are investigated. Configurations such as straight helical pinches or high-β stellarators (where the plasma column is surrounded by a force-free region) are considered in the sharp-boundary, flat-pressure-profile approximation. The plasma current and pressure can be large. The appropriate boundary conditions are imposed by solving a self-consistent double-free-boundary problem in the approximation of an almost circular, otherwise arbitrary cross-section. The helical field can be an arbitrary superposition of small helical field components with different l-numbers and equal winding period length. The plasma boundary determines the external currents or vice versa. (auth)

31750 (IPP-6/125) PLASMA TRANSPORT EQUATIONS FOR HIGH FLOW VELOCITIES. Salat, A. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Jun 1974. 28p. INIS.

14 refs.; 8 tabs. With abstract.

Collision terms for plasma transport equations are derived from the Fokker-Planck equation without the usual linearization in U = flow velocity/thermal velocity. A 13-moment approximation for the distribution functions includes the linearized dependence of the collision terms on viscous pressure and heat flow in the transport equations for momentum, energy, viscous pressure and heat flow. The masses, densities, flow velocities and temperatures of the species are arbitrary. Simplified results for small mass ratio or equal masses are given. For moderate velocities the collision terms are expanded in powers of U. Some of the resulting lowest order terms are nonlinear. These usually neglected collision terms may be important for moderate U. (auth)

31751 (UCID-15725) CALCULATED ION ANGULAR DISTRIBUTION IN ALICE BASEBALL I. Foote, J. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Sep 1970. 26p. Dep. NTIS $4.50.

The trapped-ion angular distribution was calculated for the plasma of the Alice Baseball I controlled-thermonuclear-research experiment, using the single-particle-orbit computer code TIBRO and its auxiliary routines. Computed orbits representing 105 trapping positions, for ions all of the same energy, are weighted and summed to obtain the angular-distribution results. Possible collective particle effects are not included in these calculations. Data are presented principally for the inner plasma volume, where the ion density is greatest. Some data are also given for the outer plasma regions. In the peak-density region, the angular distribution is maximum at 90° (ion velocity vector perpendicular to the local magnetic-field direction) and falls to zero near 45 and 135°. The value for a characteristic measure of the angular-distribution spread, $\overline{v_\parallel^2}/\overline{v_\perp^2}$, calculated from the computed data presented here for the peak-ion-density region near the center, depends on the amount of streaming gas assumed but is in the range 0.073 to 0.095. The corresponding value for a collisional-equilibrium loss-cone distribution in a magnetic field with the same mirror ratio as Baseball I (2.1 : 1) is 0.126. (auth)

31752 (UCID-15821) GENERALIZED EQUATION FOR RELATIVISTIC BEAM EXPANSION. Lee, E. P.; Pearlstein, L. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Mar 1971. 13p. Dep. NTIS $4.00.

A generalization of the Nordsieck equation for the expansion of a relativistic electron beam is derived using a fluid model. This equation differs from that of A. Nordsieck in two respects. First, it is more general in that it applies to beams of arbitrary current and field profile; and hence it is useful in current numerical work. Secondly, in the case of a square beam profile, the expansion rate is double that derived by Nordsieck. This ambiguity has been noted before and originates in the uneven expansion rate predicted from the particle model. Essentially, the mean expansion of the beam is found while Nordsieck considers the expansion of a circular orbit at the beam radius. (auth)

31753 (UCID-15921) PLASMA CHANNEL FORMED BY A RELATIVISTIC ELECTRON BEAM IN A GAS. Lauer, E. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Oct 1971. 23p. Dep. NTIS $4.25.

A 6-MeV electron beam with currents from 200 to 500 A was injected into hydrogen gas at pressures from 0.2 to 40 torr. Two quantities were measured: τ_m, the decay time constant for the monopole plasma current distribution and $\int n_e dl$ calculated along a diameter of the channel. A simple model was used to find self-consistent values of channel radius r_c, electron density n_e, electron temperature T_e, and collision frequency ν_m. It is pointed out that the results are strongly affected by unstable beam motion. Estimates are given for the production of ionization by two simple mechanisms. The blow-up of the equilibrium beam radius due to scattering for these measurements in hydrogen is negligible. (auth)

31754 (UCRL-51615) HYBRID-II, A TWO-DIMENSIONAL MULTISPECIES FOKKER–PLANCK COMPUTER CODE. Mirin, A. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 26 Jul 1974. Contract W-7405-eng-48. 49p. Dep. NTIS $4.00.

The computer program HYBRID-II solves the two-dimensional Fokker–Planck equation for an arbitrary number of ion species plus electrons, with the assumption that the electron distribution is isotropic. The ion equations are advanced using a second-order fully implicit split difference scheme. An implicit algorithm is used to advance the electron equation. The ion velocity and angular finite difference meshes usually consist of 45 and 20 points, respectively. The electron velocity mesh, which is an extension of the ion velocity mesh, usually consists of 201 points. The field length for a three-species calculation on the above mesh is approximately 230000_8, and the running time is 5 to 10 minutes on the CDC 7600, depending, of course, on the number of time steps necessary. The code operates without disk files or tapes. The necessary input consists merely of data cards. Both CRT plots and either HSP or microfiche printed data make up the output. (auth)

31755 PLASMA TURBULENCE IN THE PRESENCE OF A CONSTANT MAGNETIC FIELD. Drift Approximation. Tessarotto, M. (Univ., Trieste, Italy). Plasma Phys.; 16: No. 8, 772-775(Aug 1974).

It has recently been pointed out that a number of formulas valid for turbulent unmagnetized plasmas, i.e., the consistency equation for the diffusion tensor and the dielectric constant must be corrected to take into account the statistical orbit effect due to average orbit modifications. An explicit derivation of a consistency equation for the diffusion tensor and an expression for the dielectric constant starting from an analysis of the statistical properties of electric field correlations and average particle orbits is given. (UK)

31756 DIFFUSION THEORY OF STRONG, STABLE E LAYERS. Humphries, S. (Cornell Univ., Ithaca, NY). Plasma Phys.; 16: No. 8, 705-715(Aug 1974).

A diffusion theory is presented that treats the long term behavior of strong electron rings (E layers) with and without an applied toroidal field. Loss rates and decay characteristics are predicted that are in good agreement with experimental results from the astron and the Cornell relativistic electron coil experiment. Self consistent density distributions and changes of the E layer energy are also discussed. The average radius of the layer as a function of energy, magnetic fields, and surrounding conducting boundaries is calculated for typical experimental situations. (auth)

31757 THERMAL RELAXATION OF A TWO-DIMENSIONAL PLASMA IN A DC MAGNETIC FIELD. I. Theory. Hsu, J. Y.; Montgomery, D.; Joyce, G. (Iowa Univ., Iowa City). J. Plasma Phys.; 12: No. 1, 21-26(Aug 1974).

A theory is presented for the rate of thermal relaxation of a two-dimensional plasma in a strong uniform dc magnetic field. The Vahala–Montgomery (Vahala, G. & Montgomery, D., 1971, J. Plasma Phys. 6, 425) kinetic description is completed by providing a cut-off time for the time of interaction of two particles which contribute to the collision term. The kinetic equation predicts that thermal relaxation occurs as a function of the dimensionless time $(\omega_p t)(\omega_p/\Omega)(n_0 \lambda_D^3)^{-\frac{1}{2}}$, where ω_p is the plasma frequency, Ω is the gyrofrequency, and $n_0\lambda_D^3$ is the number of particles per Debye square. By contrast, in the absence of an external magnetic field, a two-dimensional plasma relaxes as a function of $(\omega_p t)(n_0\lambda_D^2)^{-1}$. (auth)

31758 THERMAL RELAXATION OF A TWO-DIMENSIONAL PLASMA IN A DC MAGNETIC FIELD. II. Numerical Simulation. Hsu, J. Y.; Joyce, G.; Montgomery, D. (Iowa Univ., Iowa City). J. Plasma Phys.; 12: No. 1, 27-31(Aug 1974).

The thermal relaxation process for a spatially uniform two-dimensional plasma in a uniform dc magnetic field is simulated numerically. Thermal relaxation times are defined in terms of the time necessary for the numerically computed Boltzmann H function to decrease through a given part of the distance to its minimum value. Dependence of relaxation time on two parameters is studied: number of particles per Debye square $n_0\lambda_D^2$ and ratio of gyrofrequency to plasma frequency Ω/ω_p. When Ω^2/ω_p^2 becomes $\gg[\ln (L/2\pi\lambda_D)]^{-\frac{1}{2}}$, where L is the linear dimension of the system, it is found that the relaxation time varies to a good approximation as $(n_0\lambda_D^2)^{\frac{1}{2}}$ and Ω/ω_p. (auth)

31759 COLLISION INTEGRALS OF ELECTRONICALLY EXCITED STATES AND TRANSPORT COEFFICIENTS OF THERMAL PLASMAS. Capitelli, M.; Lamanna, U. (Univ., Bari, Italy). J. Plasma Phys.; 12: No. 1, 71-79(Aug 1974).

Collision integrals of excited hydrogen atoms were calculated in the temperature range 10000 to 25000°K. These values were used for calculating the viscosity η and the contribution of the heavy components λ_H to the translational thermal conductivity of a LTE hydrogen plasma. The results show a dependence of η and λ_H on the calculated transport cross sections. (auth)

31760 SHOCK-RADIATION RECOMBINATION AS A DIFFUSION PROCESS. Zimin, A. G. Inzh.-Fiz. Zh.; 27: No. 1, 85-91(Jul 1974). (In Russian).

Diffusional approximation of the system of kinetic equations for ionization processes results in a general case in a hyperbolic diffusion equation which describes with sufficient accuracy the transitions between essentially discrete levels including the lowest one. This is due to preservation of discrete properties of the transition probability and possible combination of the hyperbolic equation and exact kinetic equation for the boundary level. At the upper levels this equation transits into the known parabolic Fokker–Planck equation which describes infinite-rate diffusion. A quasi-stationary process of shock-radiation recombination is considered on the basis of a steady-state diffusion equation, the conditions of quasi-stationarity being investigated. The recombination coefficient calculated with exact diffusion coefficient accounting for the processes with sharply asymmetric transition velocities essentially differs from the known result obtained by L. P. Pitaevsky on the basis of the steady-state Fokker–Planck equation for dense and comparatively low-temperature plasma. (auth)

31761 IONIZATION-DIFFUSION OSCILLATIONS OF CHARGED-PARTICLE AND METASTABLE-ATOM DENSITIES IN A PLASMA. Alanakyan, Yu. R. (All-Union Scientific-Research Inst. of Physicotechnical and Radiotechnical Measurements, Moscow). High Temp. (USSR) (Engl. Transl.); 11: No. 5, 990-992(1973).

Translated from Teplofiz. Vys. Temp.; 11: No. 5, 1113-1115 (1973).

A new type of ionization-diffusion oscillation is found which is due to multistage ionization of atoms, ambipolar diffusion of charged particles, and recombination at the walls. It is noted that in contrast to the present case, the ionization-diffusion oscillations occurring in direct ionization are only possible in the plasma of a dense foreign neutral gas which does not participate in the ionization processes. (auth)

31762 EDDY CURRENTS IN A MOVING PLASMA IN THE REGION OF A MAGNETIC FIELD JUMP. Grigoriadi, A. K.; Emets, Yu. P.; Rashchepkin, A. P. (Inst. of Electrodynamics, Kiev). High Temp. (USSR) (Engl. Transl.); 11: No. 5, 823-829 (1973).

Translated from Teplofiz. Vys. Temp.; 11: No. 5, 913-921 (1973).

The influence of the velocity profile on the current distribution in an anisotropically conducting plasma moving along a channel was investigated in the region of a sharp change in the external magnetic field. A general solution of the problem was obtained using the theory of the Riemann boundary value problem, and the structure of the eddy currents was analyzed for five characteristic velocity profiles. For these velocities, Joule dissipation in the plasma was determined over a wide range of the Hall parameter. (auth)

31763 DYNAMICS OF RUNAWAY ELECTRONS IN TOROIDAL SYSTEMS. Spong, D. A. (Oak Ridge National Lab., TN); Clarke, J. F.; Kammash, T. Nucl. Fusion; 14: No. 4, 507-510 (Sep 1974).

A self-consistent model of the runaway electron acceleration process that includes electron drift orbits was developed. Two

new effects obtained by the analysis are a shrinkage of the beam radius with time and a limitation on the maximum attainable γ, $\gamma_{max} \lesssim (W_{ce}/W_{pe})^2$, in such a beam. For the ORMAK runaway regime data, these results are minor corrections to a previously developed model which did not include drift orbits. However, for higher-energy-density runaway beams, the drift orbit effects may become more significant. (auth)

31764 DISPERSION OF A PLASMA CLOUD IN A HOMOGENEOUS MAGNETIC FIELD. Bakhrakh, S. M.; Gubkov, E. V.; Zhmailo, V. A.; Terekhin, V. A. Zashch. Pokrytiya Metal.; No. 4, 146-148(1974). (In Russian).

A description is given of a numerical solution of a two-dimensional gasdynamic problem on the dispersion of a plasma cloud in a homogeneous, infinite magnetic field. Perturbation of the field and deformation of the cloud are taken into account in a self-consistent manner. (SJR)

31765 PLANE SHOCK WAVES MOVING AT A CONSTANT VELOCITY IN PLASMA HEATED BY THERMAL CONDUCTION. Kaliski, S. (Inst. of Fundamental Technological Research, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Tech.; 22: No. 5, 439-443(1974).

The profile of the laser pulse necessary to produce a plane thermal wave front moving in plasma at a constant velocity is determined. The case of one- and two-temperature plasma as well as the effect of heat of thermonuclear fusion are the object of consideration. (auth)

31766 NONLINEAR REFLECTION OF LASER RADIATION BY A PLASMA LAYER IN A COHERENT WAVE DESCRIPTION. Andersson, D.; Wilhelmsson, H. (Chalmers Univ. of Tech., Goteborg). Nucl. Fusion; 14: No. 4, 537-546(Sep 1974).

A theoretical analysis is presented for the problem of anomalous reflection of laser radiation by a plasma due to stimulated scattering by ion-acoustic or electron plasma waves (stimulated Brillouin or Raman scattering). A coherent wave (or well-defined phase) description is used to investigate the case of perpendicular incidence on plasma layer. The reflection coefficient as found from the analysis is studied as a function of the power of the laser radiation and of the plasma parameters. The results are compared with those obtained from other investigations. Finally, numerical estimates are given for situations of interest for laser fusion. (auth)

31767 CLASSES OF SIMPLE ANALYTIC AXISYMMETRIC EQUILIBRIA. Pfirsch, D.; Rebhan, E. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). Nucl. Fusion; 14: No. 4, 547-551(Sep 1974).

Simple analytic solutions of the linear axisymmetric magnetohydrodynamic equilibrium problem are derived by differentiation of more complicated separated solutions with respect to the separation parameter. In the simplest case, a closed representation of all possible polynomial solutions is obtained. (auth)

Production

Refer also to abstract 31907.

31768 (CONF-740402-P2, pp 25-35) RECENT RESULTS OF LASER INDUCED FUSION TESTS AT KMS FUSION. Gomberg, H. J.; Charatis, G. (KMS Fusion, Inc., Ann Arbor, MI). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

Recent results obtained in the KMS fusion test program are presented. Operation of the pulse forming network and the combined CGE preamplifier-G.E. main amplifier laser system are described. Performance of the new f 0.16 target illumination system is demonstrated using test results from a CD_2 pellet. Measurement techniques and some results are given. (auth)

31769 (UCID-15843) EXCITED STATE CONTRIBUTION TO THE TOTAL IONIZATION IN THE 2XII POTASSIUM BEAM PLASMA DENSITY PROBE. Hiskes, J. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Apr 1971. 9p. Dep. NTIS $4.00.

The plasma density probe for the 2XII experiment employs a 6-keV neutral potassium beam produced by charge exchange of a potassium ion beam in potassium vapor. The charge exchange process will populate the excited levels of the beam as well as the ground state, and the subsequent ionization of these excited levels by collision with the plasma ions may lead to an overestimate of the plasma density. An upper limit is derived for the excited state contribution to the total ionization. (auth)

31770 FUSION BY MEANS OF HIGH-POWER LASERS. Eidmann, K. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany). Experimentelle Plasmaphysik 4). Atomwirt., Atomtech.; 19: No. 8/9, 451(Aug 1974). (In German).

From 7th European conference on plasma production by high power lasers; Garching, F.R. Germany (22 May 1974).

A summarizing report on the 7th European Conference on Plasma Plasma Production by High-Power Lasers, Garching, April 22 - 26, 1974 is presented. (auth)

31771 NUCLEAR FUSION WITH LASERS. Sigel, R. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). Umsch. Wiss. Tech.; 74: No. 12, 386-390(Jun 1974). (In German).

3 figs.; 2 refs.

High-Power lasers offer a new way to controlled thermonuclear fusion. The principle of implosion heating of thermonuclear fuel pellets and the present state of research in this field are discussed. (auth)

31772 LASER FUSION. Ashby, D. E. T. F. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Phys. Bull. (London); 25: 343(Aug 1974).

The basic idea of laser fusion involves initiating thermonuclear reactions by heating a D-T pellet to high temperature (~10^8°C) by irradiation with a short (~10^{-9}s) pulse of laser radiation and relying on inertia to contain the reactants. A short review of recent published work on the theory of laser fusion is given. Little has been reported on the experimental investigation of the central problem of compression. The programs on laser fusion research currently being undertaken by various countries are mentioned. The approaches to controlled fusion by laser fusion and by magnetic confinement are compared. If laser fusion is to be easily achievable then compressions of 10^3 or so with neutron yields of 10^{12} and greater should be reported in the next two years; if proof of principle is not demonstrated by 1980 then the approach is probably sterile although the high energy densities produced by laser irradiation of matter should remain a fascinating field of study for many years. (UK)

31773 CONTINUOUS DROPLET SOURCE FOR PLASMA PRODUCTION WITH PULSE LASERS. Schwenn, U.; Sigel, R. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). J. Phys., E (London); 7: No. 9, 715-718(Sep 1974).

The principle of a continuous droplet source for plasma production with a repetitively pulsed laser is described. A prototype has been successfully operated with water. (auth)

31774 SIMPLE NONEQUILIBRIUM MODEL FOR SHOCK-HEATED MONATOMIC GAS IRRADIATED BY AN INTENSE LASER BEAM. Cohen, H. D.; Su, F. Y.; Boni, A. A. (Systems, Science, and Software, La Jolla, CA). J. Appl. Phys.; 45: No. 6, 2547-2550(Jun 1974).

A method of analysis is presented by which the Maxwellianized electron cascade equations are coupled to the fluid-mechanics conservation equations for the purpose of investigating the effect of a shock-induced flow field on breakdown. A particular example of breakdown initiated behind a previously existing blast wave in argon is investigated. It is shown that the breakdown process may be hindered by the rapid hydrodynamic cooling due to geometrical expansion of the mass element under consideration. (auth)

31775 EFFECT OF A SUPERTHERMAL ELECTRON TAIL ON THE YIELD RATIO OBTAINED FROM DT-TARGETS ILLUMINATED WITH A SHAPED LASER PULSE. Lindl, J. D. (Univ. of California, Livermore). Nucl. Fusion; 14: No. 4, 511-515 (Sep 1974).

The possibility of achieving super-high compression of a bare drop of thermonuclear fuel using a shaped laser pulse depends sensitively on the electron distribution produced when the laser is absorbed. Particle simulation results indicate that laser energy absorbed near the critical density by parametric decay instabilities produces a long energetic tail of electrons which can be fit by an exponential of the form $\exp(-\frac{1}{2} mv^2/\alpha kT_e)$ where α is typically about 12 and T_e is the temperature of the background electrons. The yield from a given size pellet is sensitive both to the energy in the tail and to the slope of the tail as determined by α. This paper presents calculations of the optimized yield ratio for various α's and for varying fractions, f, in the tail for a target which is a 60 μg sphere of D-T. With an isotropic source of hot electrons produced in the absorption process, for α = 24, the worst case for this target, somewhat better than breakeven is achieved with 100 kilojoules of input energy and 30% of the laser energy in a superthermal tail. With α = 6, about 5 times breakeven is achieved with an input of 150 kJ and all of the laser energy in a superthermal tail. For comparison, when all of the energy is deposited into an

inverse bremsstrahlung spectrum, the same target yields 2.2 megajoules with an input of 46 kilojoules. (auth)

Stability

31776 (CONF-740402-P2, pp 276-288) HELICAL-FIELD AND CONDUCTING-SHELL FEEDBACK STABILIZATION OF TOROIDAL THETA PINCH. Ma, B. M. (Iowa State Univ. of Science and Tech., Ames). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

The helical-field and/or conducting-shell feedback stabilization for toroidal theta pinch devices is presented. The theoretical equations of plasma perturbation, equilibrium, force balance, and instability growth rate are derived using the percent ordering and expansion techniques based on the experimental results of the 5-meter Scyllac sector. From the plasma perturbation, equilibrium, and force balance equations, the helical fields needed for externally controlled feedback stabilization are obtained. From the instability growth rate equations derived from the various ordering and expansion techniques, the effectiveness of the internally built-in conducting shell feedback stabilization is analyzed. The helical-field or conducting-shell feedback stabilization for a toroidal theta pinch can be operated independently and economically. Although the present toroidal theta pinch devices may have the capability to produce a sufficiently high-temperature T and high-density n plasma for a controlled fusion reactor, the increase in the plasma containment time τ seems to be necessary to meet the $n\tau$ criterion of a controlled D-T thermonuclear reactor. (auth)

31777 (CONF-740402-P2, pp 289-300) IMPURITY AND INJECTION ENERGY EFFECTS ON TOROIDAL REACTOR DYNAMICS. Kammash, T.; Galbraith, D. L. (Univ. of Michigan, Ann Arbor). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

The effects of impurities and energetic ion injection on thermal stability were investigated for states of thermal equilibrium. An increase in the density of impurity ions always causes the system to become less stable. For small (low power) reactors, the impurity causes the power output to drop, however, for large (high power) reactors, a high impurity level may enable a given torus to produce more power. For a plasma diffusing according to the drift wave law, large improvements in stability are possible through use of energetic ion injection (between 10 and 50 keV), but only when the injected power reaches an appreciable fraction of the fusion power. No equilibrium states could be found for a plasma diffusing according to the neoclassical law, except for a small region of unstable equilibria obtainable only with injection energies of about 400 keV. (auth)

31778 (CONF-740402-P2, pp 320-336) COMPUTER CONTROLLED FEEDBACK STABILIZATION OF AN MHD PLASMA INSTABILITY. Merckel, G. (IBM Corp., Boca Raton, FL). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

A general MHD model is presented which describes the spatial-time dependent properties of a plasma perturbation through the concept of a displacement vector. The temporal properties of the unbounded plasma transient are characterized by the development and solution of the dispersion relationship which relate the wave number and frequency of the particular unstable mode. Next, the effects on the plasma dynamics due to the additional magnetic control flux densities is formulated through an energy density imbalance condition. After a description of the fusion reactor and the concomitant distributed sensor based computer control system, the formulation of an on-line algorithm based on optical and state error control theory is summarized. Finally, the simulation results and the requirements for a sensor based computer control system as applied to a controlled thermonuclear reactor are reviewed. (auth)

31779 (CONF-740402-P2, pp 355-363) STABILIZING CONTROL OF D-T FUSION SYSTEMS. El-Bassioni, A. A.; Husseiny, A. A. (Carnegie-Mellon Univ., Pittsburgh). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

The influence of stabilizing feedback control on the plasma in D-T fusion systems is investigated. The control can be achieved by changes in injection, external heating and enhancement of bremsstrahlung radiation. The Pontryagin and Mikhailov criteria are used to identify the domains of linear stability. Stabilization effects are found to take place with a varying magnitude depending on the control mode. (auth)

31780 (IPP-1/145) IDEAL MHD INSTABILITIES AS AN INITIAL BOUNDARY-VALUE PROBLEM. Bateman, G.; Schneider, W.; Grossmann, W. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Apr 1974. 45p. INIS.

22 figs.; 20 refs. With abstract.

The gross MHD instabilities of straight cylindrical plasmas with elongated cross-section are investigated by solving the linearized MHD equations as an initial boundary-value problem on the computer. Fourier analysis along the ignorable coordinate of the equilibrium reduces the computation to two dimensions. The method is applied to find the fixed-boundary instabilities of an equilibrium with rectangular walls. The dominant instability overwhelms all stable oscillations after several e-folding times. The growth rates of the fastest growing instabilities as a function of the equilibrium parameters are determined. The spatial structure of the physical variables is examined. The cross section of the velocity field displays a distinctive convection pattern. This structure becomes spatially concentrated around the point of maximum rotational transforms as the equilibrium current is decreased to the marginal point and concentrates near the wall as the current is increased. The marginal current density J_{mc} for each mode increases as the cross section is elongated. The growth rates of the higher azimuthal m-modes increase with elongation and their intervals of instability overlap with the lower m-modes. (GE)

31781 SUPPRESSION OF KELVIN-HELMHOLTZ INSTABILITY BY ELECTRON PLASMA WAVES. Sugai, H.; Sato, N. (Tohoku Univ., Sendai). Plasma Phys.; 16: No. 8, 775-778(Aug 1974).

A preliminary experiment is reported on a transverse Kelvin-Helmholtz instability in the presence of electron plasma waves propagating along a collisionless plasma column. Large-amplitude electron plasma waves are found to be effective in suppressing the Kelvin-Helmholtz instability. (UK)

31782 TEMPERATURE GRADIENT DRIVEN ION ACOUSTIC INSTABILITY. Allan, W.; Sanderson, J. J. (Saint Andrews Univ., Eng.). Plasma Phys.; 16: No. 8, 753-767(Aug 1974).

The stability of ion acoustic waves propagating in a magnetized plasma containing an electron temperature gradient was investigated. The dispersion relation was solved numerically for various electron-ion temperature ratios and electron temperature gradient drift velocities. Earlier predictions, based on analytic calculations for small temperature ratios and drift velocities, are confirmed and some new results are presented. In particular it is shown that a temperature gradient is a more effective destabilizing agent than a simple drift between ions and electrons. Dispersion plots and neutral stability curves are given. (auth)

31783 EXPERIMENTAL VERIFICATION OF PARAMETRIC RESONANCE INSTABILITY THEORY. Aihara, S.; Dixon, V. A.; Jancarik, J.; Lampis, G.; Takamura, S.; Waston, C. J. H. (Nagoya Univ., Japan). Plasma Phys.; 16: No. 8, 717-734(Aug 1974).

The theory of the parametric resonance instability due to Silin (Silin, V. P. (1965) ZhETF, 48, 1679; (1965) JETP, 21, 1127; (1969) ZhETF, 57, 183; (1970) JETP, 30, 105) predicts a shift in the frequency of ion acoustic waves propagating in a plasma in the presence of a high frequency electric field. An experiment has been performed in which ion acoustic waves spontaneously produced in a back-diffusion type plasma exhibit an increase in their frequency, when a radio frequency electric field is applied. The validity of the theory of Silin is confirmed by the experiment. (auth)

31784 BEAM-PLASMA INSTABILITY IN A NONUNIFORM PLASMA. Schmidt, G. (Stevens Inst. of Tech., Hoboken, NJ). Phys. Rev. Lett.; 33: No. 5, 287-291(29 Jul 1974).

The behavior of the beam-plasma instability in a nonuniform plasma depends only on the dimensionless quantity $\lambda \sim k_i^{-2}\partial k/\partial x$, where k_i is the spatial growth rate in the homogeneous plasma. If $|\lambda| \geq 1$ the instability is quenched. (auth)

31785 SPIRAL INSTABILITY OF A PLASMA FILAMENT OF ELLIPTICAL CROSS SECTION. Solov'ev, L. S. Sov. At. Energy (Engl. Transl.); 34: No. 3, 264-266(Mar 1973).

Translated from At. Energ. (USSR); 34: No. 3, 207-209(Mar 1973).

The hydromagnetic stability conditions are derived for a plasma filament of elliptical cross section relative to spiral perturbations for the cases of homogeneous and surface longitudinal currents. The stability conditions are a generalization of the Shafranov–Kruskal criterion for the case of a plasma filament of elliptical cross section, and in electromagnetic units they take the form for the cases of homogeneous current and surface current. (MOW)

31786 POSSIBLE SUPPRESSION OF A PLASMA CYCLOTRON INSTABILITY BY ELECTRON BEAM MODULATION. Karkhov, A. N. Sov. At. Energy (Engl. Transl.); 34: No. 1, 60-62(Jan 1973). Translated from At. Energ. (USSR); 34: No. 1, 46-47(Jan 1973).

A density modulated electron beam was transmitted along H_z and controlled by a feedback system. The particle velocity and the beam modulation law were chosen so that the beam electrons could compensate the separation of the changes caused by the instability. It is shown that one can expect the suppression of the instability. The analysis is given for an ideal case. (MOW)

31787 ELECTRON THERMAL INSTABILITY IN A RESISTIVE NONEQUILIBRIUM FULLY IONIZED PLASMA. Haines, M. G. (Imperial Coll. of Science and Tech., London). J. Plasma Phys.; 12: No. 1, 1-14(Aug 1974).

An electron thermal instability is proposed, which could explain the occurrence of the break-up of a plasma shell into separated current elements during the early history of a discharge. Inclusion of electron thermal conduction and Faraday's law leads to an optimum wavelength for growth, in good agreement with recent results on a θ pinch at NRL, Washington. Finally, the addition of ion motion leads to a modification of the stability criterion. The nonconvective instability exists only at low temperature and high density; but a convective instability now appears, which persists at high temperature, and could be relevant to fusion conditions. (auth)

31788 EFFECT OF HALL CURRENT ON THE INSTABILITY OF AN ANISOTROPIC PLASMA JET. Srivastava, K. M. (Kernforschungsanlage, Juelich GmbH, Ger.). J. Plasma Phys.; 12: No. 1, 33-43(Aug 1974).

The modified Chew–Goldberger–Low (CGL) equations are applied to the effect of Hall current on the instability of an incompressible plasma jet surrounded by non-conducting, compressible matter. The dispersion relation is obtained and discussed. The following is found: (i) When λ (the ratio of plasma density to the density of surrounding medium) is much greater than unity, the plasma jet is unstable for all wave numbers for which $k^* = K/\alpha < [(4R^2 - 1)/(1 + V_a^2)]^{1/2}$, where $R^2 = p_{||}/p_\perp$, $V_a^2 = H^2/4\pi\rho$, $K = (l^2 + \alpha^2)^{1/2}$. Also, the jet is unstable for $R^2 > 1 + V_a^2$. (ii) When $\lambda \ll 1$, the critical wave number ratio for the instability to set in is $k^* < [(V_a^2 + 3R^2)/(1 + V_a^2)]^{1/2}$. Also, the jet becomes unstable for $R^2 < 1/3$. (iii) When either $l = 0$ or $\alpha = 0$, we must have $R^2 > 1 + V_a^2$ for instability. It is established that the Hall current has a destabilizing effect for certain wave numbers. The dispersion relation for the incompressible plasma jet in cylindrical geometry is solved numerically on a computer. (auth)

31789 EQUILIBRIUM AND STABILITY AT THE RELATIVISTIC PLASMA-MAGNETIC FIELD INTERFACE. Fu, K. Y. (National Taiwan Univ., Taipei). Chin. J. Phys. (Taiwan); 11: No. 2, 147-150(Oct 1973).

It is shown that the instability at the relativistic plasma–magnetic field interface may lead to enhanced mixing as the nonequilibrium at the nonrelativistic plasma–magnetic field interface increases. Both effects result from the plasma motion relative to the magnetic field. (auth)

31790 INFLUENCE OF LIMITERS ON THE PENETRATION OF AN OSCILLATING AXIAL CURRENT IN A STRAIGHT PINCHED DISCHARGE. Jones, I. R. (Flinders Univ. of South Australia, Bedford Park); Peiry, J. M.; Troyon, F. S. Nucl. Fusion; 14: No. 4, 497-502(Sep 1974).

Schemes for the dynamic stabilization of pinches which rely on oscillating magnetic fields transverse to the main static field encounter severe difficulties caused by the screening of the field by residual plasma. It is shown that insulating limiters, regularly spaced along a discharge tube, suppress this screening effect by exciting stationary torsional hydromagnetic waves in the space between adjacent limiters, thus enabling the axial oscillating current to flow on the central plasma core. (auth)

31791 NUMERICAL STUDY OF DISPLACEMENT INSTABILITY IN ELONGATED TOKAMAK. Lackner, K. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.); Macmahon, A. B. Contract AT(40-1)-4478. Nucl. Fusion; 14: No. 4, 575-577 (Sep 1974).

For general vertically elongated plasma cross sections, in toroidal geometry and for different plasma current distributions, modes with $k_z = 0$ can be considered a critical test function for the gross stability of the discharge column. As this rigid, vertical displacement mode is not influenced by the toroidal field, its appearance does not depend on the safety factor q. A computation is given of the force resulting from a rigid vertical displacement of an infinitely conducting plasma column by a small distance. One can also include other rigid, infinitely conducting surfaces in the calculations, simulating stabilizing copper-shell segments. (MOW)

31792 INHIBITION OF ION SOUND INSTABILITY BY ELECTRON TRAPPING IN TOROIDAL SYSTEMS. Hazeltine, R. D.; Hinton, F. L. (Univ. of Texas, Austin). Nucl. Fusion; 14: No. 4, 503-505(Sep 1974).

Certain results of neoclassical transport theory are used to examine the effect of toroidicity on the ion sound instability in a tokamak-type system in the low-collision-frequency, banana regime. It is shown that ion sound waves are generally stable except very close to the magnetic axis, $r/R \leq (m_e/m_i)^{1/4}$. (auth)

31793 F. L. R. EFFECTS ON RAYLEIGH–TAYLOR INSTABILITY OF A PLASMA. Gemawat, K.; Srivastava, K. M. (Univ. of Jodhpur, India). Indian J. Phys.; 48: No. 3, 259-268(Mar 1974).

The effect of finite ion-Larmor radius (FLR) was studied on the Rayleigh–Taylor instability of a plasma bounded by vacuum. The whole medium is embedded by a uniform magnetic field acting parallel to gravity. The FLR effects were included through the stress tensor. The dispersion relation was obtained and discussed assuming that the inclusion of gyro-viscosity modifies the growth rates and introduces new instability modes which could be ignored. The growth rates were obtained with the help of the computer. It was established that the gyro-viscosity reduces the instability of the system. (auth)

31794 TOKAMAK STABILITY AT HIGH PLASMA PRESSURES. Mikhailovskii, A. B. (Inst. of Atomic Energy, Moscow). Nucl. Fusion; 14: No. 4, 483-492(Sep 1974).

The hydromagnetic stability of a tokamak of circular cross-section for high values of β_J, the ratio between the plasma pressure and the pressure of the poloidal magnetic field, is studied. It is shown that, for $\beta_J \gtrsim (R/a_0)^{1/2}$ (R, a_0 being the large and small radii of the torus), the tokamak is more stable than for small values of β_J. (auth)

31795 EFFECT OF IMPURITIES ON TRAPPED-PARTICLE INSTABILITIES. Ross, D. W. (Univ. of Texas, Austin). Nucl. Fusion; 14: No. 3, 447-451(Jun 1974).

The problem is considered for the case in which only the hydrogen ions are assumed to be in the banana regime, while the impurities are collisional. Since the impurity ion collisionality parameter, $\nu_j/(\epsilon^{3/2}\omega_{bj})$, where ω_{bj} is the untrapped-particle transit frequency, is Z_j^2 times that of hydrogen, this is the appropriate regime for high-Z ions even in the thermonuclear regime and for medium-Z ions at slightly lower temperatures. Only the simplest radially localized theory is considered. (MOW)

31796 STABILITY EXPERIMENT WITH DYNAMIC LIMITER IN JFT-2 TOKAMAK. Sugawara, T.; Itoh, S.; Suzuki, N.; Takeda, T.; Toi, K. (Japan Atomic Energy Research Inst., Tokai). Nucl. Fusion; 14: No. 3, 451-453(Jun 1974).

The retractable limiter of the JFT-2 machine consists of two separated molybdenum plates; the time variation of the separation distance after pulling-off is shown. The effect of the limiter on the stability is investigated. Two kinds of discharges with a dynamic limiter placed at a fixed position were chosen as reference discharges. One of them is a stable discharge with a low plasma current and the other one is an unstable discharge with a high current. Some measurements showing limiter effects are described. (MOW)

Thermonuclear Engineering and Equipment

Refer also to abstracts 32748 and 34254.

31797 (ANL/CTR-74-01) STUDY OF THE DEVELOPMENT OF NEUTRON AND PLASMA RADIATION TEST FACILITIES FOR THE CTR MATERIALS PROGRAM. Persiani, P. J. (Argonne National Lab., Ill. (USA)). Jul 1974. Contract W-31-109-Eng-38. 16p. Dep. NTIS $4.00.

The Controlled Thermonuclear Research (CTR) program needs for high-energy and high-intensity neutron and plasma sources were investigated. The assessments include outlining source requirements, facilities available, and concepts for source develop-

ment. The study of neutron and plasma radiation testing requirements for the CTR Materials Program indicated the need for developing several different types of testing facilities. An extensive R&D program was found necessary in order to scope the feasibility of translating various concepts into optimum radiation testing facilities. The development must be phased into a time scale consistent with the scheduled objectives of the overall CTR Technology Program. (auth)

31798 (CONF-740402-P1) PROCEEDINGS OF THE FIRST TOPICAL MEETING ON THE TECHNOLOGY OF CONTROLLED NUCLEAR FUSION, SAN DIEGO, CALIFORNIA, APRIL 16–18, 1974. Volume I. Hopkins, G. R.; Yalof, B. (Eds.). (American Nuclear Society, San Diego, Calif. (USA). San Diego Section). 1974. 710p. Dep. NTIS $13.60.

Separate abstracts were prepared for 26 of the included papers. Abstracts for the remaining 32 papers have appeared previously in NSA. For abstracts of these see CONF-740402 in the report number index. (MOW)

For abstracts of individual papers see: 31799–31824.

31799 (CONF-740402-P1, pp 21-37) PRELIMINARY DESIGN OF A MINIMUM SIZE TECHNICAL FEASIBILITY TOKAMAK FUSION REACTOR. Bertolini, E.; Brunelli, B.; Englemann, F. (CNEN, Frascati, Italy). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear susion. Volume I.

A self-consistent plasma model has been allowed to define the main parameters of the minimum size reactor, taking into account physical and engineering limitations. A confinement time safety factor with respect to neoclassical one both for electrons and ions $F_{El} = 0.1$ was assumed. As reactor specifications, a plasma radius of 2 m and a power of 180 MW(th) was taken. The position of the coils and the currents necessary to produce the required magnetic surfaces have been evaluated consistently with the plasma stability and equilibrium conditions. Blanket and magnet shielding are arranged in a modular form, helium cooling and stainless steel as structural materials were assumed. Boron carbide powder is the main component of the magnet shielding. A preliminary design of the superconducting Nb–Ti, D-shaped magnet has been performed, the maximum field being 8 tesla. The divertor is of poloidal type, with a single stagnation point. The whole reactor, including the magnets, is contained in a vacuum tight vessel. (auth)

31800 (CONF-740402-P1, pp 38-55) CONCEPTUAL DESIGN OF A TOKAMAK FUSION POWER REACTOR, UWMAK-I. Kulcinski, G. L.; Conn, R. W. (Univ. of Wisconsin, Madison). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The design details of a low β, D–T fusion reactor based on the Tokamak confinement concept are described. The thermal output of the plant is 5000 MW_{th}. The basic structural material is 316 stainless steel and the coolant, moderator and breeding medium is liquid lithium. Materials compatibility limits the maximum coolant temperature to 500°C and the electrical output to 1500 MW_e. The ion temperature of the 5 meter radius plasma is 11.1 keV and the mean confinement time and fractional burnup are 14.2 seconds and 7.2% respectively. A double null poloidal divertor is used to protect the plasma from impurities. Cryogenically stabilized niobium-titanium superconducting magnets are used to provide a 3.82 Tesla field on the plasma axis. Neutron and photon transport calculations indicate the breeding ratio in UWMAK-I is 1.49 and doubling times may be as low as 2–3 months. The tritium leakage is 10.1 curies per day. The total energy per fusion neutron, including the 3.52 MeV alpha particle, is calculated to be 20.08 MeV. Radiation embrittlement of the stainless steel limits the first wall lifetime to 2 years while swelling and/or surface erosion limits the wall life to ~5 years. Radioactivity and afterheat calculations reveal that after 10 years of operation there will be 1.6×10^9 curies of activity and 31 MW_t of afterheat. It is concluded that even though the UWMAK-I is a relatively conservative design, major advances in the state of plasma physics and materials technology would be required before such a plant could be built. (auth)

31801 (CONF-740402-P1, pp 56-69) TECHNOLOGICAL IMPLICATIONS FOR TOKAMAK FUSION REACTORS OF THE UWMAK-I CONCEPTUAL DESIGN. Conn, R. W.; Kulcinski, G. L. (Univ. of Wisconsin, Madison). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The major conclusions from the conceptual design of a Tokamak fusion reactor, UWMAK-I, are presented. The implications of the basic results and areas of major uncertainty are described. Many of the technological problems posed by such a reactor appear solvable within reasonable extensions of existing technology but some major advances remain to come in two general areas, plasma physics and technology, and materials, particularly first wall problems, before such fusion reactors are possible. (auth)

31802 (CONF-740402-P1, pp 83-95) LASER FUSION REACTOR CONCEPT UTILIZING MAGNETIC FIELDS FOR CAVITY WALL PROTECTION. Frank, T.; Freiwald, D.; Merson, T.; Devaney, J. (Los Alamos Scientific Lab., NW). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The x radiation, neutron and α emissions, and energetic debris associated with the TN burn and microexplosion of laser illuminated DT microspheres will produce severe cavity environments for conceptual laser fusion reactors, especially when considering high pulse rates (1 to 10 Hz). Various concepts have been proposed for cavity first wall protection and energy dissipation and recovery. The concept of protection from energetic α particles and ionized pellet debris by diversion, wherein charged particles are channeled by magnetic fields to engineered energy sinks, is discussed. (auth)

31803 (CONF-740402-P1, pp 124-133) MODULAR CONCEPT OF A FUSION REACTOR. Dauzvardis, P. V. (Argonne National Lab., IL). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

A modular reactor for the theta-pinch plasma confinement concept suggests a means of aiding high plant availability for central-station fusion power plants. Advantages include ease of handling, accessibility, quick module replacement, simplified vacuum pumping, and ready identification of the source of reactor malfunction. The design criteria of such a modular reactor and how it is integrated to an overall power plant conceptual will be discussed. Arrangement of reactor subsystems peculiar to the fusion process are included. The proposed concept is keyed on reactor maintenance and isolation of potentially hazardous areas. (auth)

31804 (CONF-740402-P1, pp 137-141) PLANNED AND RUNNING ACTIVITIES IN THE FIELD OF FUSION REACTOR TECHNOLOGY IN THE FEDERAL REPUBLIC OF GERMANY. Schmitter, K. H. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

For 1974 funds totalling DM 18.8 million have been allocated. The fusion reactor technology program will be based on reactor design studies of low-beta toroidal confinement, high-beta toroidal confinement, mirror confinement, and inertial confinement. The program includes the following fields: reactor design studies, plasma-wall interaction, plasma heating and refuelling, material research and reactor structure, blanket and tritium technology, and fusion reactor electrotechnology. One of the fields on which the program places special emphasis is divertor development and related questions. The field of blanket and tritium technology is mainly concerned with comparative studies of blanket cooling concepts and with evaluation of the tritium inventory. The experimental work involves the thermodynamics and reaction kinetics of the lithium-tritium system and studies of tritium separation technology. The activities in plasma heating and fuel injection cover rf heating, neutral injection and problems of pellet and cluster interaction with hot, dense plasmas. Concerning magnet technology and energy storage, the most important items, in the program are experimental and theoretical studies necessary for preparing design specifications for large, superconducting, toroidal magnets. It is planned to build a prototype toroidal magnet. Furthermore, investigations are being made on energy storage components and systems for high-beta reactors. (auth)

31805 (CONF-740402-P1, pp 154-158) PHYSICS AND ENGINEERING CONSIDERATIONS IN LASER CTR REACTOR DESIGN. Hyde, R.; Wood, L.; Nuckolls, J. (Univ. of California, Livermore). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The optimal design of a laser fusion reactor is strongly dependent on the type of pellet which is to be burned. Thus, within the generic label of laser fusion reactor there are a variety of significantly different reactors, burning DT at (relatively) low ρRs, DD at intermediate ρRs, and pB^{11} and other advanced fuels at high ρRs. This variety of fuels within the laser fusion field has no corollary in magnetic CTR devices, whose burn modes correspond to very low ρR pellets. In high ρR laser fusion reactors, fuels which have no ignition temperature may nonetheless be efficiently burned. There is no analog of this burn mode in magnetic CTR, which apparently precludes utilization of the superclean fusion fuels in magnetic fusion machines. (auth)

31806 (CONF-740402-P1, pp 159-164) PROPULSION APPLICATIONS OF LASER-INDUCED FUSION MICROEXPLOSIONS. Hyde, R.; Wood, L.; Nuckolls, J. (Univ. of California, Livermore). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

Laser-fusion reactors have substantial potential as power sources for propulsion of large aircraft, ships and extraterrestrial craft. Due to the much greater value of energy in such applications relative to that produced in fixed central power stations, some such applications may be expected prior to the advent of a laser CTR energy economy. Economic, durability and reliability constraints are among those which are greatly relaxed in such power systems, particularly in military vehicles. Engineering design for such systems may aptly commence shortly after laser fusion energy breakeven is experimentally demonstrated, several years hence. This paper very briefly considers the three primary classes of propulsion applications in the laser CTR vehicle propulsion sector: marine, aircraft and exoatmospheric vehicles. (auth)

31807 (CONF-740402-P1, pp 187-196) PARAMETRIC SYSTEMS ANALYSIS OF A THETA-PINCH FUSION POWER PLANT. Amend, W. E.; Burke, R. J.; Cook, J. (Argonne National Lab., IL). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The development of an overall computer model of a theta-pinch fusion power plant is discussed. The development is begun with a conservation of energy model using an energy flow diagram to specify energy flows through basic systems interfaces. Top-down structured programming methodology is used to obtain a continuously working computer model. In this way, parameter variation on the overall plant operation may be studied even though the model is incomplete in many respects. (auth)

31808 (CONF-740402-P1, pp 199-210) GEOMETRY AND PERFORMANCE OF A THETA-PINCH POWER BREEDER. Braun, G. W.; Lidsky, L. M. (Massachusetts Inst. of Tech., Cambridge). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

Fusion devices of the roughly 1000 thermal megawatt average power level now being considered represent neutron sources of sufficient strength for industrial scale fertile to fissile conversion. If the net economics of the fusion device must be optimized in a fuel economy where the LMFBR-Pu fuel cycle is dominant, then the fuel cycle constraints favor a fusion blanket resembling a fast subcritical fission reactor. An example of such a blanket is developed for a theta-pinch fusion reactor geometry. General considerations for such a device are illustrated, and it is shown that a heterogeneous blanket design is capable of providing two to three times the energy multiplication and fissile gain of a homogeneous system. It is emphasized that the theta-pinch is subject to particularly severe engineering and economic liabilities and that even the optimum theta-pinch-LMFBR system may fail to be competitive with respect to other possible mixed or "pure" nuclear power cycles. (auth)

31809 (CONF-740402-P1, pp 256-270) NEUTRONIC AND PHOTONIC ANALYSES OF FUSION REACTOR BLANKETS CONTAINING NATURAL URANIUM. Parish, T. A.; Draper, E. L. Jr. (Univ. of Texas, Austin). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The neutronic and photonic characteristics of fusion reactor blankets containing natural uranium fission fuel were investigated. The basic neutron cross section data used in the analyses were taken from the ENDF/B Version III library. Neutron multi-group constants were generated with SUPERTOG. Neutron Kerma factors for all materials except uranium were calculated with AVKER. POPOP4 and POPLIB were used to generate the secondary gamma ray production cross sections. Photon cross sections were computed with MUG. Computer programs were written to compute cross sections for the (n,3n) reactions, neutron kerma factors, and resonance self-shielding effects. The ANISN program was used for the neutron and gamma ray transport calculations. The standard blanket model was calculated to verify the methods. The natural uranium fuel was added to the standard blanket which was liquid lithium cooled and possessed a niobium vacuum wall. The thickness of the region containing uranium was varied. Reaction rates such as (n,γ), (n,2n), etc., were calculated for the first and second niobium walls of the blankets. In addition, the tritium breeding, fission power, and heat deposition by blanket region were computed and presented for the fusion-fission blankets. The energy leakages from these blankets were also calculated and compared to the results for the standard blanket. (auth)

31810 (CONF-740402-P1, pp 283-293) STUDY OF THE DEVELOPMENT OF NEUTRON AND PLASMA RADIATION TEST FACILITIES FOR THE CTR MATERIALS PROGRAM. Persiani, P. J. (Argonne National Lab., IL). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

A study of neutron and plasma radiation testing requirements for the CTR Materials Program indicated the need for developing several different types of testing facilities. An extensive R&D program is found necessary in order to scope the feasibility of translating various concepts into optimum radiation testing facilities. The development must be phased into a time scale consistent with the scheduled objectives of the overall CTR Technology Program. (auth)

31811 (CONF-740402-P1, pp 350-362) CONCEPTUAL DESIGN OF A THETA-PINCH FUSION ENGINEERING RESEARCH FACILITY. Burke, R. J.; Coultas, T. A.; Petrick, M. (Argonne National Lab., IL). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The first iteration on the design of a Fusion Engineering Research Facility (FERF) based upon the theta-pinch heating and containment method is presented. The comparatively vast areas and volumes available for experimentation are described. Cooling and plasma containment facets of the design are also discussed. (auth)

31812 (CONF-740402-P1, pp 417-422) POLOIDAL DIVERTOR FOR THE UWMAK-I TOKAMAK REACTOR. Emmert, G. A.; Mense, A. T.; Donhowe, J. M. (Univ. of Wisconsin, Madison). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The Wisconsin Tokamak Reactor Design (UWMAK-I) incorporporates a poloidal divertor to establish a plasma boundary away from the first wall and to reduce wall erosion by energetic charged particle bombardment and the subsequent release of impurities into the plasma. The divertor is axisymmetric and of the double-null type which produces a "D" shaped plasma surface. The particle collectors are a liquid lithium film flowing under gravity down a flat plate. (auth)

31813 (CONF-740402-P1, pp 423-431) USE OF EFFUSORS TO IMPROVE DIVERTORS PERFORMANCE. Husseiny, A. A. (Carnegie-Mellon Univ., Pittsburgh); Sabri, Z. A.; Impink, A. J. Jr. 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The possibility of augmenting the function of present magnetic divertors by the use of effusors is investigated. The conventional wall of the plasma machine is replaced in this situation by an effusor in the form of a honeycomb double wall structure embodied

with ducts to convey neutral gases. The first wall is to be fabricated from porous materials compatible with the high temperature and neutronic environment of the plasma device. The second wall is to be constructed from a material of very low permeability to reduce the flow of tritium from the blanket to the gas channels. Two designs are investigated: One design envisages fueling of the plasma core by a sweep gas while impurities and ash effuse to the gas channels for transport out of the device; the other design contemplates all neutrals retention within the sweep gas channels. Protection of the plasma from the impurities influx can be improved by the use of any of these designs. (auth)

31814 (CONF-740402-P1, pp 467-475) TRITIUM DEMAND FOR FUSION REACTOR DEVELOPMENT. Koehler, W. H.; Voss, J. (INTERATOM, Bensberg, Ger.). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

An estimate is made of the amount and timing of external tritium supplies for fusion reactor development. Comparing this to estimated tritium supplies as by-products of fission reactors it is concluded that additional sources of tritium will have to be made available between 1982 and 2000. The possibility of producing tritium in PWR power reactors is sketched. (auth)

31815 (CONF-740402-P1, pp 504-518) SOME CONSIDERATIONS IN THE PROCESSING OF D–T PLASMA EFFLUENTS. Impink, A. J. Jr. (Carnegie-Mellon Univ., Pittsburgh); Sabri, Z. A.; Husseiny, A. A. 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The processing of D–T plasma effluent in gaseous form to obtain a recycle fuel stream containing an acceptable concentration of helium and a waste stream with minimal tritium concentration is not yet well established. Potential limitations in terms either of excessive tritium holdup or of inadequate separation of fuel and waste species can be identified in all processes thus far identified as usable in gaseous effluent processing. If a reasonably effective partitioning scheme functioning on-line, either in the reacting or exhausting plasma, or after collection of the effluent, and yielding partial separation of helium from deuterium and tritium, can be used to feed a two stream effluent handling system, an acceptable trade off of power derating against tritium holdup with high ultimate tritium utilization appears to be obtainable. A gaseous effluent processing system based on these concepts would be appropriate for tokamak or stellarator systems fueled by neutral beam injection or background gas uptake or for currently envisioned theta pinch power reactors. (auth)

31816 (CONF-740402-P1, pp 519-530) SYNTHETIC FUELS FROM FUSION REACTORS. Powell, J. R.; Salzano, F. J.; Sevian, W.; Bezler, P. (Brookhaven National Lab., Upton, NY). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The technical, environmental and economic features of a synthetic fuels economy based on fusion reactors is evaluated. Analyses of alternate possible U.S. energy systems for 2020 AD indicate that CTRs can deliver synthetic fuels based on electrolytic hydrogen (H_2 gas, H_2 liquid and methanol) at costs competitive with natural fossil fuels and synthetic fuels derived from coal. With less conservative CTR and synthetic fuel production technology, CTR-derived synthetic fuels should be substantially cheaper than fossil fuels. A synthetic fuels economy based on CTRs has substantial environmental benefits, including much lower chemical and radioactive emissions and the elimination of strip mining. The effect of various tokamak reactor parameters is examined, including q, β_0, first wall loading, reactor size, and fuel cycle. Large reactor sizes appear feasible, up to 20 GW(e) electrical, because of the larger market and larger transmission distances with synthetic fuels. The DD fuel cycle yields production costs comparable to those using DT fuel. (auth)

31817 (CONF-740402-P1, pp 533-547) MINIMUM ACTIVITY BLANKETS USING ALUMINUM STRUCTURE. Powell, J.; Aronson, A.; Bezler, P.; Miles, F.; Winsche, W. (Brookhaven National Lab., Upton, NY). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The use of aluminum structures in fusion reactor blankets can result in very low activation inventories, on the order of 1 Ci/MW(e). Tritium is bred in solid lithium compounds, e.g., LiAl, from which it diffuses into a helium coolant stream or into the vacuum region surrounding the plasma. It can be recovered in a variety of ways, including absorption in a metal hydride bed. Tritium blanket inventories are ~10 to 100 Ci/MW(e), much less than possible with liquid lithium or flibe blankets. Acceptable thermal cycle efficiencies, 30 to 40%, depending on design, are achieved by thermally isolating the cool aluminum structure from the bulk of the blanket, and minimizing the energy input to the aluminum (typically one-third of the fusion energy). The repair and maintenance of minimum activity blankets become much easier, and spent blanket structures can probably be disposed of by direct burial. (auth)

31818 (CONF-740402-P1, pp 564-577) ENVIRONMENTAL IMPACT STUDY OF A REFERENCE THETA-PINCH REACTOR (RTPR). Draley, J. E. (Argonne National Lab., IL); Maroni, V. A.; Coultas, T. A.; Krakowski, R. A. 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The recently completed engineering design study for the Reference Theta-Pinch Reactor (RTPR) has allowed an assessment of the potential environmental impact of an RTPR power plant to be made. During normal operation of the plant, tritium is expected to be released at a rate of 6 Ci/day, an amount that would lead to low maximum doses (0.06 to 0.8 mrem/yr, depending on site and cooling options). These doses, and the anticipated integrated population doses, are considerably less than doses now considered acceptable. Problems related to (1) the required commitment of some natural resources (e.g., beryllium and niobium), (2) the disposition of activated structural materials and other radioactive waste (76,700 kg/yr or 12 GCi/yr at shutdown) for a five-year niobium component lifetime, and (3) land despoilment are substantial but do not appear to compromise the viability of RTPRs as a useful power source. Consideration of the occurrence of severe accidents (e.g., liquid-metal fires) and other unusual incidents indicates that their effects will be contained within the plant, but that they may be costly. Radiation doses resulting from accidental release of the operating tritium inventory during a liquid-metal fire would probably be below the level now permitted for fission plants. (auth)

31819 (CONF-740402-P1, pp 578-587) INDUCED ACTIVITY AND DECAY POWER OF THE STRUCTURE OF A STAINLESS STEEL FUSION REACTOR BLANKET. Nigg, D. W. (Texas Agricultural and Mechanical Univ., College Station); Davidson, J. N. 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

Activation calculations were made for a simple, standard blanket design previously described and used for several benchmark calculations. The structural material is 316 stainless steel and the neutron fluxes used were the results of a 100 energy group, S_4–P_3 calculation in an infinite cylinder geometry using the DTF-IV code. Thirty-nine separate reactions, involving all fourteen of the major isotopes of stainless steel and producing thirty-two radioactive species, were considered in the calculation of the blanket activity and decay power. With the exception of the manganese-55 reactions, which are available in 100 group form on ENDF/B-III files, the cross sections were generated from empirical formulae and various reports of experimental data. The results of the calculation show that the induced activity is 2.0 curies per watt of thermal power after 10 years of operation, about one half of the value for a comparable blanket with niobium structure. Approximately one half of this activity is due to the isotope iron-55. The decay heat at the end of 10 years of operation is 17 milliwatts per watt of thermal power. This power is 50% greater than that calculated for a niobium blanket, but is primarily due to short lived isotopes so that ten days after shutdown the afterheat is reduced by two thirds. The major long term radiation hazard appears to be associated with the isotopes manganese-54 and cobalt-60 which after 10 years of operation will have an activity of about 0.13 and 0.015 curie per watt of thermal power, respectively. (auth)

31820 (CONF-740402-P1, pp 599-607) EMERGENCY COOLING AND AFTERHEATING EFFECTS OF A CTR BLANKET. Sze, D. K. (Univ. of Wisconsin, Madison). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The thermal effects of loss of flow accident and afterheat to a UWMAK-I type blanket are investigated. The temperature response of the first wall, as the whole blanket are calculated with a finite difference method. For a loss of flow accident, the plasma has to be quenched between 10 to 60 seconds, beyond which we may lose the first wall. The temperature of the first wall does not present a serious problem due to afterheat. No freezing will occur in the blanket within two days of reactor shutdown so that the blanket does not have to be evaluated. (auth)

31821 (CONF-740402-P1, pp 634-641) THERMAL STATE OF THE FUSION BLANKET. Nishikawa, M.; Ioki, K.; Naito, T.; Asami, N. (Mitsubishi Atomic Power Industries, Inc., Omiya, Japan). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

Thermal analysis of the fusion blanket was carried out with purpose of evaluating the structural material. Assuming the simple model, heat deposition rate in the structural substance was calculated for 2 Mw/m^2 wall loading and 0.08 Mw/m^2 radiation heating. Heating deposition rate takes its maximum value of about 38 w/cm^3 at the first wall and exponentially decreases towards outer. As candidate structural materials, molybdenum, niobium, vanadium and type-316 stainless steel were chosen. Temperature distribution and thermal stress in the first wall and circular rod placed in the blanket were calculated. Comparing these results with the estimated allowable stress and temperature of each material, evaluation of structural materials was made. According to the thermal aspect, molybdenum is the most suited for structural material. Niobium, vanadium and type-316 stainless steel follow in this order. (auth)

31822 (CONF-740402-P1, pp 652-663) USE OF ELECTRICAL INSULATION IN LITHIUM-COOLED FUSION REACTOR BLANKETS. Sze, D. K.; Stewart, W. E. (Univ. of Wisconsin, Madison). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The performance of lithium-cooled fusion reactor blankets can be substantially improved if electrical insulators can be used. Plant efficiencies can be increased, wall stresses can be reduced, and higher wall loadings and magnetic fields can be employed. Case studies are given for a Tokamak reactor to show the improvement attainable as a function of the operating conditions permitted for the insulating material. (auth)

31823 (CONF-740402-P1, pp 664-676) DESIGN OF A BOILING POTASSIUM HEAT REMOVAL SYSTEM FOR FUSION REACTORS. Parkin, J. R.; Schmidt, P. S.; Vliet, G. C. (Univ. of Texas, Austin). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The design of a fusion reactor blanket utilizing boiling potassium as a heat transfer medium is described. Emphasis is on the evaluation of geometric and cooling performance gains obtainable with the high effective heat transfer coefficients characteristic of boiling liquid metals. A two-dimensional heat transfer code was used to determine the placement of cooling tubes. Sensitivity of the tube spacing to variations in the first wall radiation flux and boiling heat transfer coefficient was also studied. Estimates of total coolant volume, flow rate, and pumping power are presented and compared with helium and direct lithium cooled systems. (auth)

31824 (CONF-740402-P1, pp 685-698) NUCLEAR DESIGN OF THE MAGNET SHIELD FOR FUSION REACTORS. Abdou, M. A.; Maynard, C. W. (Univ. of Wisconsin, Madison). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume I.

The results are presented of a quantitative study of some important features of the nuclear design of a magnet shield for fusion reactors operating on the D-T cycle and utilizing superconducting magnets for confining the plasma. The shield is required to perform three major functions: (1) reduce the nuclear radiation heating of the cryogenic coils to a permissible level to be defined shortly, (2) reduce the radiation to the superinsulation which forms a thermal barrier between the magnet and the shield to a level that will allow it to function properly without excessive radiation damage for a satisfactory lifetime (~20 years), and (3) keep the radiation to the magnet to the minimum allowed by (a) a tolerable increase in the resistivity of the copper stabilizer and (b) the radiation damage to the superconductor. (MOW)

31825 (CONF-740402-P2) PROCEEDINGS OF THE FIRST TOPICAL MEETING ON THE TECHNOLOGY OF CONTROLLED NUCLEAR FUSION, SAN DIEGO, CALIFORNIA, APRIL 16-18, 1974. Volume II. Hopkins, G. R.; Yalof, B. (Eds.). (American Nuclear Society, San Diego, Calif. (USA). San Diego Section). 1974. 560p. Dep. NTIS $13.60.

Separate abstracts were prepared for 33 of the 50 included papers. Abstracts for the remaining 17 papers have appeared previously in NSA. For abstracts of these see CONF-740402 in the report number index. (MOW)

For abstracts of individual papers see: 31724, 31725, 31736, 31768, 31776-31779, and 31826-31850.

31826 (CONF-740402-P2, pp 53-62) DIRECT CONVERSION OF NEUTRON ENERGY AND OTHER ADVANTAGES OF A LARGE YIELD PER PULSE, INERTIAL-CONFINEMENT FUSION REACTOR. Burke, R. J.; Cutting, J. C. (Argonne National Lab., IL). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

Aspects of an inertial-confinement, fusion reactor that uses an energy release $\gtrsim 10^{11}$ joules are discussed. The large energy release makes possible direct conversion of the fusion neutrons' energy after nuclear heating of an evaporated blanket to the plasma state. Surface damage by charged particles is avoided and structural damage by neutrons is alleviated. Complex fuel assemblies and other expendable parts may be used as a result of the high monetary value of the energy release. (auth)

31827 (CONF-740402-P2, pp 77-86) TRITIUM BREEDING IN CERAMIC LITHIUM-COMPOUND BLANKET. Seki, Y.; Sako, K.; Tanaka, K.; Hiraoka, T. (Japan Atomic Energy Research Inst., Tokai). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

The results of the neutronics calculations on tritium breeding in a fusion reactor blanket with ceramic lithium compound are presented. Tritium breeding capabilities, material consistency and tritium recovery method of four lithium compounds are investigated. Lithium oxide appeared to be the most promising for the blanket material. Parametric study on the tritium breeding of a lithium oxide blanket system are carried out. From the results of the study it is made clear that in the lithium oxide blanket, the maximum tritium breeding ratio available is about 1.25 without particular introduction of neutron multiplying material. It is also shown that the blanket thickness of 50 cm is sufficient to give the tritium breeding ratio of 1.15. (auth)

31828 (CONF-740402-P2, pp 87-100) NEUTRONICS AND PHOTONICS STUDY OF FUSION REACTOR BLANKETS. Abdou, M. A.; Maynard, C. W. (Univ. of Wisconsin, Madison). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

A comparative study of several structural materials proposed for use in CTR blankets was carried out. The question of increasing the energy production in the blanket is considered. A comparison of the nuclear performance of several materials in the reflector region is presented. (MOW)

31829 (CONF-740402-P2, pp 136-144) BLANKET DESIGN AND CROSS-SECTION SENSITIVITY CALCULATIONS BASED ON PERTURBATION METHODS. Gerstl, S. A. W. (Argonne National Lab., IL). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

Perturbation theory is applied to perform neutronics survey calculations and determine sensitivities of certain neutronics parameters to blanket design changes. The computational procedure is described and typical applications to the Reference Theta-Pinch Reactor (RTPR) are performed to investigate the accuracy of this approximate method. It is concluded that perturbation theory provides an extremely versatile tool for CTR blanket design and cross-section sensitivity calculations, especially for applications to fairly complex blanket systems when quick answers are needed during the engineering design process. The accuracy

of perturbation theory is considered adequate for one-dimensional neutronics survey and sensitivity calculations even when large design changes are considered. (auth)

31830 (CONF-740402-P2, pp 145-154) TRITIUM BREEDING POTENTIAL OF THE PRINCETON REFERENCE FUSION POWER PLANT. Greenspan, E.; Price, W. G. Jr. (Princeton Univ., NJ). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

A variational method is used to investigate the tritium breeding potential of the blanket of a fusion reactor. Effectiveness functions indicating the changes in the breeding ratio due to material density perturbations are calculated with the code SWAN. Results are presented analyzing the sensitivity of the BR both to cross section variations and to material density perturbations. For example, SWAN indicates a 0.176 increase in BR for the replacement of 10% of the flibe by beryllium. Implications of the sensitivity figures for design modification and optimization are discussed. (auth)

31831 (CONF-740402-P2, pp 155-165) USE OF TANTALUM AND LIQUID LEAD IN A FUSION REACTOR BLANKET. Davey, W. G. (Argonne National Lab., Idaho Falls, ID); Parish, E.; Beck, C. L.; Palmer, R. G. 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

Some major criteria for fusion reactor blanket design are discussed including minimization of radiation damage and acceptable heat deposition rates, particularly in the first wall, good neutron economy to give a tritium breeding ratio greater than unity with practical engineering designs. Discussion of the systematic behavior of relevant cross section with nuclear mass and neutron excess shows that certain types of materials are to be preferred. As an illustration of the type of design which results from these considerations a blanket incorporating tantalum structural material and lead or bismuth as a combined neutron multiplier, gamma shield, and coolant is formulated. Neutronic and photonic scoping calculations are made on variants of such a blanket to confirm that desirable features are quantitatively correct. The objective is to discuss some important criteria for fusion blanket design which are determined by neutronic characteristics rather than to propose a specific design. (auth)

31832 (CONF-740402-P2, pp 193-201) INTEGRAL NEUTRONICS EXPERIMENTS ON A LITHIUM METAL ASSEMBLY. Hiraoka, T.; Maekawa, H.; Seki, Y.; Hirota, J. (Japan Atomic Energy Research Inst., Tokai). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

A spherical lithium metal system was assembled by lithium blocks for investigation of neutronics of the fusion reactor blanket. Reaction rate traverses were measured by fission chembers of ^{232}Th, ^{238}U, ^{237}Np and ^{235}U. Penetration of 14-MeV neutrons were also measured by LiI scintillation counter. Their results were compared with the calculations. It became clear that the neutrons above a few MeV in the system were well evaluated. (auth)

31833 (CONF-740402-P2, pp 202-217) NEUTRON FERMI AGE IN GRAPHITE FROM FISSION AND FUSION SOURCES TO INDIUM RESONANCE. Etzion, M.; Draper, E. L. Jr.; Nichols, S. P.; Davey, W. G. (Univ. of Texas, Austin). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

In order to provide benchmark measurements against which fusion reactor blanket calculations can be tested, a series of large volume experiments has been initiated. The benchmarks are designed to provide simple geometry assemblies, many mean free paths in thickness, to test transport cross sections and analytical techniques. Because graphite may be found in substantial quantities in fusion reactor blankets it is important to be able to predict neutron migration accurately in large samples. Furthermore, graphite's rather simple cross section provides a good check on calculational techniques involving deep penetration with predominantly forward scattering. The present work compares measured ages and higher moments to indium resonance from a ^{252}Cf fission spectrum to previous fission spectrum experiments and calculations. New calculations are included. Measured and calculated ages and higher moments are also presented for a 14 MeV source. These results are compared to the single previous calculation. (auth)

31834 (CONF-740402-P2, pp 238-249) NUCLEAR BLANKET AND SHIELDING PROBLEMS IN DEMONSTRATION FUSION REACTORS. Casini, G.; Cuniberti, R. (EURATOM, Ispra, Italy). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

The main results of nuclear parametric calculations carried out for the conceptual design of the blanket and shielding of the FINTOR reactor are presented. The effect on tritium breeding of blanket and reflector thickness and composition was investigated. Different neutron shielding materials were analyzed by means of a simplified calculation method (SABINE). A D-shaped blanket is proposed. (auth)

31835 (CONF-740402-P2, pp 253-264) CONCEPTUAL DESIGN OF OPEN SYSTEM REACTOR WITH RF PLUGGING. Hatori, T., Hiroe, S.; Miyahara, A.; Sato, T.; Takayama, K.; Watanabe, T.; Watari, T. (Nagoya Univ., Japan). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

The scheme of an open system reactor is presented based on the use of cusp confinement with the adiabatic rf plugs. Examples of parameters of this reactor system are shown. If the system length of 100 meters is adopted, it is guaranteed that the rf field strength keeps within the reach of present technology, and the power balance limitation is satisfied. Such a possibility for a fusion reactor arises from the advantages of cusp configuration: an external rf field can penetrate well inside the plasma in the line and the point cusps, resulting the marvelous suppression of ion loss flux in the experiment. Concerning heavy impurities, it is stated that the rf barrier is very low for ions with low degree of stripping. And also α-particles easily go over the barrier because of its very high energy. This scheme, therefore, retains the high purity advantage of conventional mirrors over toroidal systems. (auth)

31836 (CONF-740402-P2, pp 265-275) MAGNETIC FIELD STUDIES FOR A PROPOSED TECHNICAL FEASIBILITY TOKAMAK REACTOR. Bobbio, S. (Univ., Naples); Coccorese, E.; Esposito, F.; Greco, O. 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

In connection with FINTOR, the design magnetic field configuration in a toroidal reactor is analyzed. In the first part, aimed at equilibrium, an arrangement of external currents outside the toroidal D-shaped coils is found such that plasma boundary coincides with a magnetic surface of total field produced by both plasma and external currents. Various typical profiles of toroidal plasma current density are examined and it is found that one maintaining external field is suitable in all cases but the one characterized by an extremely peaked current distribution with the top at the external side of the torus. The possibility of including a poloidal divertor, with a single stagnation point in the interior side of the torus, is considered. Equilibrium is preserved also in this case for the same plasma current distributions but it is necessary to locate some currents inside the toroidal D-coils. In order to use superconductors, care is taken to make the net sum of such currents equal to zero. To achieve a sufficient shielding of the involved superconductors some main parameters of reactor have to be slightly modified. (auth)

31837 (CONF-740402-P2, pp 301-308) THERMAL INSTABILITIES FOR DIFFERENT FUSION FUEL CYCLES. Usher, J. L.; Campbell, H. D. (Univ. of Florida, Gainesville). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

Thermal instabilities for the D–T, D–D, and D–^{3}He fuel cycles were studied. When burn-up and subsidiary reactions were taken into account, critical temperatures, which dictate the regime of thermal stability, were found to be lower than those previously reported. The critical temperature for the D–D cycle is markedly reduced when the subsidiary D–T reactions are included. (auth)

31838 (CONF-740402-P2, pp 309-319) IGNITION, FUELLING, AND SHUTDOWN OF A D–T FUSION PLASMA. Yamato, H.; Ohta, M. (Japan Atomic Energy Research Inst., Tokai). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

The ignition and shutdown processes are discussed in a D–T tokamak reactor when the confinement time of the plasma is given by the pseudoclassical diffusion and the anomalous diffusion of trapped ion instability. A reference model reactor of 2000 MW(t) can be ignited by 30MW additional heating. At the shutdown of a reactor, the effect of increase and decrease of injection rate of fuel and also the effect of change in the mixing ratio of the fuel are investigated. In the reference reactor, smooth shutdown is possible when the injection of tritium is stopped and the injection of deuterium is doubled. As a method of fuel supply the surface fuelling by means of cold gas is compared with the pellet injection. It is shown that this method of fuelling may be applicable in a low β reactor plasma and that in this fueling system, surface temperature of the plasma can be quite low and the damage of the wall by sputtering can also be suppressed. In other words this plasma geometry may be possible to be applied in order to prevent the influx of impurity in a toroidal plasma. (auth)

31839 (CONF-740402-P2, pp 337-346) HIGH CURRENT RELATIVISTIC ELECTRON BEAM ACCELERATOR FOR FUSION APPLICATIONS. Dobbie, C. B.; Fargo, V.; Kolb, A. C.; Korn, P.; Phelps, D. A.; Ramrus, A. (Maxwell Labs., Inc., San Diego, CA). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

Experimental results are presented on the characteristics of a 1 MV–1 MA electron beam generator (MAXIBEAM) now in operation at Maxwell Laboratories, Inc. MAXIBEAM is capable of producing electron beams with up to 100 kJ energy, 10 to 90% current risetimes of 40 nanoseconds and peak power exceeding 1 Terrawatt. These characteristics represent the state-of-the-art in low impedance, high ν/γ (~20) pulsed-power technology. The application of high ν/γ electron beams to heat large plasma volumes to fusion temperatures is shown to be experimentally feasible. (auth)

31840 (CONF-740402-P2, pp 347-354) PLASMA-WALL-INTERACTION IN MAGNETICALLY CONFINED TOROIDAL FUSION REACTORS: STATUS AND PROBLEMS. Vernickel, H. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

Impurity build-up and wall erosion in a fusion reactor due to particle bombardment of the wall are discussed using a simple model. Impurity build-up appears to be serious, possibly preventing steady state operation of the reactor. The influence of various parameters is discussed and open problems are pointed out. (auth)

31841 (CONF-740402-P2, pp 364-372) OPTIMUM FUEL COMPOSITION FOR EQUILIBRIUM CTR OPERATIONS. Gralnick, S. L.; Tenney, F. H. (Princeton Univ., NJ). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

The optimization of the fusion power density for a pressure limited fusion plasma ($\beta \leq \beta_{max}$) which satisfies an equilibrium power balance between alpha power and radiation as well as transport losses is considered. The technique is to establish the locus of equilibrium temperatures which is generated by a parametric variation of the ratio of electron to fuel ion (deuterium and tritium) density, $\bar{z}$. Characteristically solutions exist at high equilibrium temperatures which are thermally stable and at lower temperatures which are thermally unstable. Stable equilibria are considered suitable for CTR operation. Both pseudoclassical type and trapped-ion mode scalings of the transport losses are considered. The need for a particle loss rate of two orders of magnitude more rapid than pseudoclassical will be demonstrated and the effect of the enhanced energy losses due to varying $\bar{z}$ explored. For pseudoclassical type scaling increased $\bar{z}$ yields higher fusion power density. Trapped ion scaling gives the opposite result. By returning a fraction of the net available power to the plasma as supplementary heating it is possible to extend the range of $\bar{z}$ for which equilibrium solutions may be found. The possibility of using power feedback and variation of $\bar{z}$ to relax thermal stability criterion will also be discussed. An alternative control mechanism, the enhanced absorption of synchrotron radiation, is considered but found to have little effect in the temperature range of CTR interest. (auth)

31842 (CONF-740402-P2, pp 400-406) ENERGETIC PARTICLE LOSS AND FIELD BUMPINESS DUE TO "D" SHAPED COILS IN A TOKAMAK REACTOR. Yang, T. F.; Emmert, G. A. (Univ. of Wisconsin, Madison). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

In conceptual designs of tokamak reactors, the ripple of the magnetic field produced by the finite number of "D" shape toroidal field coils is found to be both radial and poloidal dependent. This ripple can be modeled by a power function of minor radius and Gaussian function of poloidal angle. The fraction of energetic alpha particles trapped in the magnetic wells between coils is estimated and its minimization is discussed. (auth)

31843 (CONF-740402-P2, pp 407-412) SELF-PURIFICATION OF THERMONUCLEAR PLASMAS. Sabri, Z. A. (Iowa State Univ. of Science and Tech., Ames). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

Spatial distribution of the density of impurities in a plasma device differs from the distribution of plasma constituents due to diffusion processes that depend on mass, charge or both. A favorable situation is one in which the concentration of impurities at the outer region of the plasma core is higher than their concentration in the center portion of the core. Conditions are sought for the realization of this type of self-purifying plasma. In rotating plasma devices the centrifugal forces tend to exclude impurities from the interior of the hydrogen plasma core. In tokamak devices, the separation effects are sensitive to the plasma density and temperature profiles. Four of the currently used profiles are examined. High abundance of impurities is found to exist at the center of the plasma for all of the four models. (auth)

31844 (CONF-740402-P2, pp 413-422) TETRAHEDRALLY SYMMETRIC MAGNETIC WELL FOR TARGET PLASMA REACTORS. Vaifells, A.; Sabri, Z.; Ma, B.; Chiu, Y. C. (Iowa State Univ. of Science and Tech., Ames). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

A minimum-B, tetrahedrally symmetric magnetic well is considered for plasma confinement. Such a well has already been constructed. The magnetic field is produced by placing current coils parallel to each of the eight facets of an octahedron. Each coil passes through three of the six geometric poles on a reference sphere. The axis of each two-coil set is angularly displaced from the axes of each of the other sets by the tetrahedral angle of 109.47°. The magnetic field strength at different points within the well was determined both by measurement and by numerical analysis. Results for a set of points lying on one of the coil axes are shown together with the values which were obtained numerically. The measured and calculated values agree within the limits of experimental accuracy (5%). The peaks of magnetic field intensity are found within the boundaries demarcated by the coils. The gradient of the field increases monotonously with the distance away from the center of the well and becomes significantly large at the edges of the well. The well thus has good characteristics for plasma confinement. Theoretical analysis of the tetrahedrally symmetric well indicates that no charge separation will take place as a result of the inhomogeneity of the magnetic field. Plasma losses from the poles have to be considered, but these can be circumvented. The tetrahedrally symmetric configuration has the stability merits of cusped geometries and a higher degree of symmetry than the baseball type of configuration, as well as fewer end losses. It is particularly well suited to the target plasma types of reactors which have been introduced by Dawson, Furth, and Tenney and by Husseiny and Sabri. This is due to the combination of the properties of a steep magnetic field gradient and field symmetry for confining the cold target plasma, as well as to the multiplicity of poles for injecting ion beams into the magnetic well. (auth)

31845 (CONF-740402-P2, pp 423-433) FEASIBILITY STUDIES OF GAS INSULATION NUCLEAR FUSION REACTORS. Shioda, S. (Tokyo Inst. of Tech.). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

In order to investigate the feasibility of the gas insulation nuclear fusion reactors, the model for the plasma and the neutral gas regions is proposed. By this model, one knows the power output and the radius of the plasma-neutral gas boundary once the pressure and the velocity of the natural gas are given. Furthermore, the combination of the fusion reactor and the MHD power generator is discussed. (auth)

31846 (CONF-740402-P2, pp 437-447) FUSION REACTOR APPLICATIONS OF SILICON CARBIDE AND CARBON. Hopkins, G. R. (General Atomic Co., San Diego, CA). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

The use of silicon carbide, carbon materials, and other low atomic number materials is proposed for structural application in fusion reactor first-wall and blanket regions. Calculations for 1 MW/m^2 incident 14-MeV neutron energy flux show that decay heat is small with a maximum temperature rise of ~45°C. Long term induced radioactivities of 0.2 curies/1000 MW-yrs of ^{14}C and 3 curies/1000 MW-yrs of ^{10}Be are produced from ^{13}C isotope activations for a conceptual blanket assembly employing a 1 cm thick SiC first wall and a blanket composed of 80% lithium and 20% SiC. Significant stable transmutation products are produced, consisting primarily of 1800 appM He, 575 appM H, and 537 appM Mg, all for 1 MW/m^2 neutron energy flux on the first wall and for 1 year exposure. The effects of these on structural properties is indeterminate at this time. Significant problems in design and fabrication of large size components from non-ductile materials are apparent. The use of low atomic number materials for the first wall minimizes plasma impurity problems. The advantages of a fusion reactor with a first wall blanket structure providing very low induced radioactivity, high temperature operation and an abundant supply of raw materials appear significant enough to justify further study to solve the engineering problems. (auth)

31847 (CONF-740402-P2, pp 462-472) SUMMARY OF THE PHYSICAL AND MATERIAL CONSTRAINTS ON THE PERFORMANCE OF TOROIDAL MAGNETS FOR CONTROLLED THERMONUCLEAR REACTORS. DeMichele, D. W.; Darby, J. B. Jr. (Argonne National Lab., IL). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

A summary is given of a systems study of the physical and material requirements of large toroidal magnets suitable for fusion reactors. The purpose of this study was to determine the materials limits on magnet performance. The study consisted of a parametric analysis of the important material properties. The general toroidal magnet system made up of circular pancakes with a rectangular cross section can be described by a series of equations and inequality constraints. For a specific set of material properties, an optimal design can be determined. The results show how the optimal design and the optimal magnet performance change when the material properties of the superconductor, stabilizer and structural material are changed. Two superconducting materials, Nb_3Sn and Nb–22% Ti, and two stabilizers, high purity copper and high purity aluminum, were studied. The results show that the critical factor in obtaining high fields in toroidal magnets is the coil stiffness. The transport properties of the two stabilizers and the two superconductors appear to be adequate. The limit in magnet performance was found to be the strain limit of the superconductor. (auth)

31848 (CONF-740402-P2, pp 485-499) POTENTIAL EFFECTS OF INTERACTIONS BETWEEN TRANSMUTANTS AND DISPLACED ATOMS IN CONTROLLED THERMONUCLEAR REACTOR FIRST WALLS. Odette, G. R.; Frei, M. W. (Univ. of California, Santa Barbara). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

The influence of high transmutation rates in materials irradiated in CTR neutron environments was studied. Solid and hydrogen products are qualitatively discussed and He effects were examined using a coupled bubble-void nucleation growth model applied to thermal and fast fission reactors, as well as CTR neutron spectra for nickel at two temperatures normally associated with void and with bubble swelling. The damage microstructure was used to estimate some mechanical property changes expected to occur in the various irradiation environments. The results showed that different rates of displacement and He generation may produce qualitatively altered irradiation behavior; and that loss of ductility is likely to be a major limiting factor in CTR materials performance. (auth)

31849 (CONF-740402-P2, pp 508-516) EROSION OF SILICON CARBIDE SURFACES UNDER HELIUM ION AND 14 MeV NEUTRON IRRADIATIONS. Kaminsky, M.; Das, S. K. (Argonne National Lab., IL). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

The erosion of silicon carbide surfaces was investigated for irradiation at room temperature with 100 keV and 250 keV helium ions, and with 14 MeV neutrons. After irradiation with helium projectiles for a total dose of 0.5 C/cm^2, many pits were observed on the surface. For irradiation with 14-MeV neutrons two types of deposits were observed on the collector surfaces facing the silicon carbide target — one in the form of large chunks, the other a more even layer covering the surface. (auth)

31850 (CONF-740402-P2, pp 517-524) FORMATION OF SURFACE FEATURES ON NIOBIUM DURING HIGH TEMPERATURE HYDROGEN IRRADIATION. Bauer, W.; Thomas, G. J. (Sandia Labs., Livermore, CA). 1974.

From topical meeting on technology of controlled nuclear fusion; San Diego, California, USA (16 Apr 1974).

In proceedings of the first topical meeting on the technology of controlled nuclear fusion. Volume II.

Surface features were observed on niobium after H^+ implantation at high temperatures. It was found that the formation of these features depends on the polishing procedure, implantation temperature and dose. It is suggested that under our experimental conditions the surface features are due to oxide and/or carbide growths and do not necessarily require the presence of implanted hydrogen gas. (auth)

31851 (COO-2431-1) M.I.T. FUSION TECHNOLOGY PROGRAM. Technical Progress Report. (Massachusetts Inst. of Tech., Cambridge (USA)). 30 Jun 1974. Contract AT(11-1)-2431. 21p. Dep. NTIS $4.25.

Technical progress is summarized for the following research areas: (1) simulation of radiation effects in fusion materials, (2) assessment of the thermal design of fusion reactor systems, (3) pellet fueling of fusion reactors, and (4) technology assessments related to fusion reactors. (MOW)

31852 (IPP-1/137) SCALING OF A WALL-STABILIZED HIGH-BETA STELLARATOR. Herrnegger, F.; Kaufmann, M. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Jan 1974. 9p. INIS.

3 figs.; 7 refs. With abstract.

On the basis of the surface current model, the scaling of an $m = 1$ wall-stabilized high-β stellarator is discussed in terms of the compression ratio kappa, aspect ratio A, helical distortions δ_0, δ_1, δ_2, and β. The $m = 1$, $k = 0$ mode can be wall-stabilized for $\kappa \approx 2$, $\delta_1 \approx 1$, $A \approx 200$, $\beta \approx 0.83$, $\delta_0 \approx 0.21$, $\delta_2 \approx 0.07$. The number of periods around the torus is then $n_0 \approx 0.6\ A/\kappa^2$. (auth)

31853 (IPP-1/138) DYNAMICS OF TOROIDAL HIGH-β STELLARATORS. Neuhauser, J. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Dec 1973. 25p. INIS.

6 figs.; 15 refs. With abstract.

The influence of plasma dynamics in toroidal high-beta stellarators is investigated in an idealized, linear model (incompressible, sharp boundary) with artificial force of gravity instead of the toroidal drift force. The dynamic interference force produced by the coupling of oscillating $l = 1$ and $l = 2$ stellarator fields is calculated for frequencies near the resonance frequency of the helical modes. A simple interpretation of the frequency response is given and the influence of damping and compressibility is discussed. The result is used to explain the initial dynamics in the ISAR T 1 experiment and to estimate the effect of plasma heating by helical Alfven waves on plasma stability. (auth)

31854 (LA-UR-74-1206) FIRST WALL MATERIALS PROBLEMS IN FUSION REACTORS. Clinard, F. W. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 6p. (CONF-741015-2). Dep. NTIS $4.00.

From 21st national symposium of the American Vacuum Society; Anaheim, California, USA (19 Oct 1974).

First wall structural problems are divided into surface and bulk phenomena. Surface phenomena may include sputtering, blistering, chemical erosion, and impurity desorption. Bulk structural damage may be manifested as swelling, embrittlement, or other structural degradation, with loss of dimensional control or fracture as the possible consequence. Electric problems associated with a theta-pinch reactor are discussed along with the above effects. (MOW)

31855 (UCID-15831) COMPRESSING THE E-LAYER WITH A PULSED TOROIDAL MAGNETIC FIELD. Christofilos, N. C.

(California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Apr 1971. 13p. Dep. NTIS $4.00.

The advantages of the compression of the E-layer with a toroidal field at the Astron facility are twofold, i.e., to increase the ratio of its self-field to the poloidal guiding field thus creating a deep magnetic well to confine the plasma and to increase the E-layer electron density to a level adequate to provide by Coulomb interaction a plasma heating rate of approximately 1000 eV per millisecond. The transverse dimensions of the E-layer during the compression phase were calculated starting with initial values of transverse dimensions, transverse momentum, total energy, gyroradius, and guiding field. (MOW)

31856 (UCID-15847) FOCUSING E-LAYERS AND ELECTRON RINGS WITH TOROIDAL MAGNETIC FIELD. Christofilos, N. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 May 1971. 13p. Dep. NTIS $4.00.

The radial focusing effect of a toroidal field both during injection and trapping of the electrons which form the E-layer is discussed. The focusing effect of the toroidal field acting upon the collective axial velocity of the injected electrons was studied. The calculations were made by linearizing the radial equation of motion to study the effects of orbits undergoing small excursions from the gyroradius. (MOW)

31857 (UCID-15869) ASTRON PHYSICS AND TECHNOLOGY DURING FY 1971 (ORAL PRESENTATION TO THE STANDING COMMITTEE, JULY 7, 1971). Christofilos, N. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Jul 1971. 20p. Dep. NTIS $4.00.

Theoretical and experimental work during the last few months indicates that the combination of the Tokamak geometry with Astron is a very useful concept. There is no doubt that the E-layer with the toroidal field will prove an excellent plasma container, while heating of the plasma to fusion temperature is available free. The introduction of the toroidal field in the Astron already is proving very useful by eliminating two previously self-quenched instabilities. Thus a new degree of freedom has been acquired, i.e., trapping the E-layer in high vacuum. With the new technology added recently in the Astron facility there is no doubt that results will be generated at a rapid rate. No escalation is required. No new facilities. The Astron plasma container has not yet been demonstrated. (auth)

31858 (UCID-15904) LOSS OF ELECTRONS ON INJECTION INTO THE ASTRON. Lovelace, R. V.; Fessenden, T. J.; Berk, H. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Sep 1971. 8p. Dep. NTIS $4.00.

The salient qualitative aspects of the electron losses which occur on injection into the Astron tank were studied, i.e., with no toroidal magnetic field ($B_\theta = 0$). The losses as measured from the x-ray production occur predominantly in the first few meters down-axis from the injector. The time scale of the loss process is of the order of 4 or 5 relativistic cyclotron periods or ≈40 nsec. The losses are reduced by increasing, for example by steepening the magnetic mirror, the axial velocity v_z. The percentage of electrons lost is larger the higher the injected current. (MOW)

31859 (UCID-15916) VACUUM BEAM TRANSPORT AND THE PROBLEM OF MATCHING FROM VACUUM TO THE SPACE CHARGE NEUTRALIZED EQUILIBRIUM. Lauer, E. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Sep 1971. 21p. Dep. NTIS $4.25.

The envelope equation for the beam in vacuum is described for the case of the perpendicular temperature (neglecting the effect of forces on the particles). The equations are derived for particles with and without angular momentum. An experimental test of the envelope equation is described. (MOW)

31860 (UCID-15931) RESISTOR FOCUSING OF THE INJECTED ELECTRONS IN THE ASTRON. Christofilos, N. C.; Langdon, A. B.; Porter, G. D.; Rensink, M. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Oct 1971. 11p. Dep. NTIS $4.00.

The presence of resistor wires between the walls of the evacuated chamber and the E-layer electron bunch provides axial focusing thus removing the electrostatic defocusing which tends to expand and spread the electron bunch. Computer calculations indicated that because of geometry the electrostatic defocusing force is much larger than the magnetic focusing force. Trapping calculations are presented for introducing resistors into the cantilever within the region of the E-layer trap. (MOW)

31861 (UCID-15991) RECENT EXPERIMENTAL RESULTS ON ASTRON. Christofilos, N. C.; Condit, W. C. Jr.; Hester, R. E.; Porter, G. D.; Stallard, B. W.; Weiss, P. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Feb 1972. 32p. Dep. NTIS $4.75.

Data are given showing that the E-layer compresses itself adiabatically during the neutralization phase, provided that neutralization takes place in many tens of microseconds. Other data showing the build-up of the E-layer for various experimental conditions are described. (MOW)

31862 (UCRL-75783) SHIELD DESIGN FOR A MIRROR FUSION RESEARCH FACILITY (FERF). Wilcox, T. P. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Jun 1974. 5p. (CONF-741017-16). Dep. NTIS $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

The LLL conceptual design of a mirror reactor to be used in a Fusion Engineering Research Facility (FERF) requires a shield in order to minimize the heating and neutron radiation damage in the superconducting magnets. At the same time, the shield must be as thin as possible so that the magnets may produce the highest possible magnetic fields. A brief description of the shield is given. (MOW)

31863 POWER FOR PLASMA PHYSICS—POWER FROM PLASMA. Muntenbruch, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). Kerntechnik; 16: No. 7, 296-301(Jul 1974). (In English, German).

7 figs.; 1 tab.; 6 refs.

A survey is given on the problems of power demand in large plasma physics experiments, especially the generation of power pulse for setting up the magnetic field, where the flywheel-generator (pulsed generator) is briefly gone into (characteristic data). Furthermore, the functioning principle, brief development survey and field of application of combustion gas MHD generators (especially for the pulse power supply for plasma experiments) are given. (AH/LH)

31864 TECHNICAL PROBLEMS IN LARGE NUCLEAR FUSION EXPERIMENTS. Seidel, E. R. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). Kerntechnik; 16: No. 7, 289-295(Jul 1974). (In English, German).

10 figs.; 26 refs.

Following a review on the plasma parameters obtained up to now in the magnetic confinement of hydrogen plasmas (ion temperature, n, τ_E) as well as the plasma cross-sections and torus radii of some Tokamak experiments, the strong forces and moments occurring on the magnet coils are explained by means of the Wendelstein VII stellarator (IPP Garching) as well as the reactions of the vacuum container wall on the plasma (cooling reverse flow of particles and bremsstrahlung losses of the heavy impurity atoms) and their reduction by magnetic divertors. (GE)

31865 APPARATUS FOR PRODUCING ELECTRICITY FROM THERMONUCLEAR REACTIONS. Pedrick, A. P. British Patent 1,353,727. 22 May 1974. 5p.

Improvements are described to the apparatus described in BP 1207698 and 1282391, the object of which is to carry out a controlled nuclear fusion between D and T, or D alone, and the conversion of the released energy into electricity. A concentration of laser beams is employed to attain the temperatures required to initiate fusion. The improved apparatus is of the implosion type, in which high velocity bullets tipped with D and T pellets are made to implode on one another and produce a small spherical space in which a very high concentration of radiant energy is produced from appropriately directed laser devices. A description is included of the electrical control circuits and of the electrical power conversion means. (UK)

31866 EFFECT OF FORCE-FREE CURRENT IN EQUILIBRIUM CONFIGURATIONS FORMED WITH RELATIVISTIC ELECTRON BEAMS. Ikuta, K.; Mohri, A. (Nagoya Univ., Japan). Nucl. Fusion; 14: No. 3, 444-446(Jun 1974).

The differential equation that governs the toroidal equilibrium with the plasma current was investigated. It was assumed that the toroidal magnetic field remained a vacuum field even if $\nabla \times \vec{B} \neq 0$, i.e., no net poloidal current in the system. A cylindrical polar system centered at the axis of symmetry was used to describe the axisymmetric toroidal equilibrium with a relativistic electron beam. The various parameters of the obtained equation are discussed. (MOW)

31867 MEASUREMENT OF THE POLOIDAL FLUX PROFILE IN A TOKAMAK BY UTILIZING NEUTRAL-BEAM INJECTION. Rome, J. A. (Oak Ridge National Lab., TN); Eubank, H. P. Contract W-7405-eng-26. Nucl. Fusion; 14: No. 4, 573-574(Sep 1974).

The MHD-stability of a tokamak system is directly related to the radial variation of the poloidal flux function, $\Psi(R)$. Measuring

this profile in a direct, simple manner remains one of the paramount problems in present experiments. Neutral beams were used to directly measure the $\Psi(R)$-profile. Once $\Psi(R)$ is known, one may derive the radial profiles of the poloidal magnetic field, $B_p(R)$, and the Ohmic heating current, $J(R)$. This measurement is based upon the fact that a counterinjected (antiparallel to J) ion which is born near the outside of the torus will move outward of its birth flux surface and may hit the limiter and be lost. Thus, the hot counterinjected ions will occupy only a part of the plasma volume as shown for the circular limiter case. By measuring the size of the region of well-contained fast ions, one may obtain $\Psi(R)$. (auth)

31868 MAGNETIC-SURFACE DESTRUCTION IN TOROIDAL SYSTEMS. Hamzeh, F. M. (Univ. of California, Berkeley). Nucl. Fusion; 14: No. 4, 523-536(Sep 1974).

The behavior of the field lines in a torus is analogous to the motion of a nonlinear oscillator. If ϵ, small and positive, is the perturbation parameter, a toroidal system in which terms of higher order than ϵ are assumed to give nonobservable contributions is considered. For large nonlinearity ($x \gg \epsilon^{\frac{1}{2}}$) it was found that two sets of resonances are sufficient to explain the destruction of the magnetic surfaces in the toroidal system. Resonances that transform the unperturbed surfaces into a structure of magnetic islands are called primary resonances, and the secondary resonances transform the bound-state-like contours of a given island into similar structures of secondary magnetic islands. To every primary island two types of stochasticity are attached, an external one due to the overlapping of primary resonances and an internal one due to the overlapping of secondary resonances. Depending on the resonance and the system, the destruction of the magnetic surfaces occurs by either or both processes. For small nonlinearity ($x \lesssim \epsilon^{\frac{1}{2}}$) the magnetic contours oscillate in a highly irregular fashion and, therefore, overlap causing orbital instabilities. The orbital instabilities are more pronounced for larger fluxes but do not always destroy the flux surfaces at the separatrix. Independently of how small ϵ (> 0) is, the flux surfaces are always destroyed at the separatrix, if not by external, then by internal stochasticity. In the immediate neighborhoods of the elliptic singularities, the field lines are orbitally stable for all nonlinearities. These neighborhoods are small and may become observable for small ϵ. For the levitron, the theoretical perturbations for which some of the primary resonances are completely destroyed were calculated. These theoretical values are given and they are in good agreement with the numerical results. (auth)

31869 BEHAVIOR OF IMPURITY IONS IN A TOKAMAK PLASMA. Tazima, T.; Tanaka, M.; Yoshikawa, M.; Inoue, K. (Japan Atomic Energy Research Inst., Tokai). Nucl. Fusion; 14: No. 4, 517-522(Sep 1974).

Numerical results are presented on the steady-state distributions of oxygen impurities in various states of ionization and related energy losses in a tokamak plasma. The steady-state coupled equations of the oxygen impurities are solved taking into account classical diffusion and successive ionization-recombination processes. The results show that the plasma axis is surrounded by shells of oxygen ions in various states of ionization in agreement with an experimental observation in ST. The energy losses due to ionization and excitation of the oxygen impurities are of the same order of magnitude as the power input due to Joule heating near the plasma boundary for an oxygen concentration consistent with the experiment. This suggests that impurities may be one of the factors which lead to anomalous resistivity and energy losses of electrons observed in tokamak discharges. (auth)

Wave Phenomena

31870 (IPP-4/66) ON THE POSSIBILITY OF THE SIMULATION OF A SLOW-WAVE SYSTEM BY A PHASED ARRAY OF WAVEGUIDES. Tutter, M.; Puri, S. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Feb 1974. 9p. INIS.

2 figs.; 2 refs. With abstract.

From general considerations it is shown that neither a flush mounted waveguide nor a phased array of waveguides is capable of simulating a transverse-magnetic (TM) slow-wave structure. Their superficial resemblence to slow-wave systems is traced to the paradox of Mach's "Wave Machine". (auth)

31871 COLD PLASMA RESONANCES OUTSIDE THE WKB APPROXIMATION. Crescentini, A. A. (Consiglio Nazionale delle Ricerche, Florence). Plasma Phys.; 16: No. 8, 769-772 (Aug 1974).

As a detail of a general investigation of the problem of wave propagation in resonance regime, a plot is given of the reflection and transmission coefficients as functions of the parameter μ in the two following cases: (1) the so called magnetic beach configuration, as a simple example of accessible resonance and (2) the upper-hybrid propagation in a plasma slab, as an instance of a non-accessible resonance. (UK)

31872 WAVE PROPAGATION IN DRIFTING WEAK MAGNETOPLASMA UNDER GRAD'S THIRTEEN-MOMENT APPROXIMATION. Talekar, V. L.; Bhandari, S. S. (Malaviya Regional Engineering Coll., Jaipur, India). Plasma Phys.; 16: No. 8, 741-751(Aug 1974).

The earlier work (Talekar, V. L., and Rawat, S. S. (1973) Plasma Phys. 15, 795) on wave propagation under Grad's thirteen-moment approximation in drifting warm plasma is extended in the present study to include the effect of static magnetic fields. Collision dominated plasma is considered and the static magnetic field is taken to be weak so that the coefficients of viscosity and of thermal conductivity are still scalars. The comprehensive effect of finite viscosity, thermal conductivity, drifting motion of the plasma and the superposed static magnetic field, on the nature of the wave propagation is reported for the first time in the present investigation. It is observed that in addition to the usual splitting of electromagnetic mode, the magnetic field also causes the splitting of the plasma modes when Grad's thirteen moment approximation is applied to the plasma medium. (auth)

31873 NONLINEAR THEORY OF A QUASI-MONOCHROMATIC WHISTLER MODE PACKET IN INHOMOGENEOUS PLASMA. Karpman, V. I.; Istomin, Ya. N.; Shkiyar, D. R. (Moscow State Univ.). Plasma Phys.; 16: No. 8, 685-703(Aug 1974).

A nonlinear theory is developed for a quasi-monochromatic whistler wave packet interacting with the resonant particles in an inhomogeneous plasma. Expressions for the distribution functions for the trapped and untrapped particles are obtained on the basis of generalized theorems of phase volume conservation. A nonlinear equation is derived which describes the space–time evolution of the wave amplitude. The nonlinear growth (damping) rate at large distances from the front edge of the packet is shown to be determined by the difference between the average distribution functions of the trapped and untrapped resonant particles. Qualitative features of the nonlinear evolution of a wave packet in inhomogeneous plasma are investigated. (auth)

31874 ANOMALOUS ABSORPTION OF INTENSE ELECTROMAGNETIC WAVES IN PLASMA AT HIGH MAGNETIC FIELDS. Musil, J.; Zacek, F.; Schmiedberger, P. (Ceskoslovenska Akademie Ved, Prague). Plasma Phys.; 16: No. 8, 735-739(Aug 1974).

Conclusive evidence is presented of anomalous absorption of an intense RHCP wave at high magnetic fields $\omega_{ce}/\omega > 1$, where ω_{ce} and ω are the electron cyclotron frequency and the frequency of the electromagnetic wave. (auth)

31875 MODEL OF A PARALLEL SHOCK WAVE WITH TURBULENT DISSIPATION IN A HOT PLASMA. Auer, R. D. Muenchen, Ger.; Technische Univ. (1972). 119p. (In German). INIS.

Thesis. 20 Figs.; 62 Refs. With abstract. Available from the library of the Technische Univ. Muenchen.

The model of a shock wave is studied which propagates parallel to an external magnetic field in a collisionless plasma, with diffraction being prevented by turbulent dissipation. Turbulant dissipation is exclusively due to the non-resonant garden-hose instability initiated in the transition zone of the shock wave. A system of fluid dynamic equations is presented describing ion sound and Alfven waves of small amplitude as well as the development of the garden-hose instability and its quasilinear stabilization in agreement with kinetic theory, based upon the assumption that the plasma is collisionless, that the thermal ion pressure is high compared to the magnetic pressure, and that the electron temperature is much higher than the ion temperature so that the effect of resonant protons on the instability can be neglected and the electron pressure can be considered as being isotropic in contrast to the ion pressure. The system of equations has been completed by neglecting the heat flow of the ions and by assuming the hot electrons to be isothermal. Numerical integration yields the time-dependent development of the garden-hose instability in a homogeneous, nonstable plasma in good agreement with quasilinear theory, and further numerical, turbulent-stationary shock profiles whose mean time values agree very well with an analytical WKB-approximation derived by means of quasilinear equations for a weakly inhomogeneous plasma. (GE)

31876 EXPERIMENTAL INVESTIGATION OF SLOW-MODE SHOCK WAVES. Craig, A. D. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). J. Plasma Phys.; 12: No. 1, 149-168(Aug 1974).

An idealized, one-dimensional theoretical model of a novel method of launching a slow-mode hydromagnetic shock wave is presented. The reduction of the transverse magnetic field component, at the boundary of a semi-infinite plasma containing a uniform oblique magnetic field, results in the propagation of a fast-mode expansion wave followed by a slow-mode shock. An initial hydrogen plasma containing axial and azimuthal field is then reversed at one end of the device, by a fast-rising radial discharge. Diagnosis of the resulting flow, with small magnetic and electric probes, shows the propagation of the fast expansion wave and the slow shock; but there also follows a third wave, having the properties of a "piston". When the theory is extended to include a moving boundary (i.e., the "piston"), good quantitative agreement is obtained with the experimental results. The annular geometry of the experiment leads to centrifugal effects not considered in the one-dimensional theory; but these are not sufficient to disrupt seriously the main flow pattern. Detailed measurements of the shock indicate a dispersive structure. (auth)

31877 EXPERIMENTAL INVESTIGATION OF PARALLEL AND OBLIQUE SHOCK WAVES IN A MAGNETIZED PLASMA. Craig, A. D. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). J. Plasma Phys.; 12: No. 1, 129-148(Aug 1974).

The Charybdis apparatus is designed to produce parallel and oblique shock waves in a magnetized plasma. An initial hydrogen plasma ($n_{e1} \sim 7 \times 10^{20}$ m^{-3}, $T_1 \sim 1.3$ eV) is produced in a Pyrex chamber (0.46 m dia., 1.25 m long) containing an axial magnetic field (B_{z1} up to 0.2 T). A diffuse current front is produced in a fast-rising radial discharge between a central electrode and an annular outer electrode at one end of the chamber. The Lorentz force on the current sheet causes axial motion, and a quasisteady shock profile propagates ahead. A clear shock separation is achieved across almost the complete radial extent for a wide range of initial parameters. The shock propagation angle to the initial field ranges from 0 to 40°. The Alfven Mach number M_A of the flow is varied by changing the initial field strength. Switch-on shock behavior is demonstrated at a point of parallel propagation occurring in the shock profile. (auth)

31878 SURFACE WAVES AT A VACUUM-PLASMA INTERFACE. Clemmow, P. C.; Elgin, J. (Cambridge Univ., Eng.). J. Plasma Phys.; 12: No. 1, 91-106(Aug 1974).

It is emphasized that the dispersion relation for surface waves at a vacuum–plasma interface can be obtained by setting the reflection coefficient to zero. The relations for warm, collisional and hot, collisionless plasmas are derived in this way, and shown to be in agreement with previous results. The former relation is expressed explicitly as a cubic equation for $y \equiv 2c^2k_1^2/\omega_p^2$ as a function of $x \equiv 2\omega^2/\omega_p^2 - 1$, where k_1 is the component of the wave vector along the interface, ω is the frequency and ω_p the plasma frequency; and the nature of the three branches of the y(x) curve is analyzed in detail. The rotation of the vacuum wave vector as the frequency runs from 0 to ∞ is displayed, and it is established that one and only one branch corresponds, in the collisionless case, to pure surface waves. (auth)

31879 NONLINEAR INTERACTION OF WAVES IN AN ACTIVE MOLECULAR PLASMA. Bonnedal, M.; Wilhelmsson, H. (Chalmers Tekniska Hoegskola, Goeteborg). J. Plasma Phys.; 12: No. 1, 81-90(Aug 1974).

The wave–wave couplings that may occur in a magnetized and partially ionized plasma medium containing neutrals (or ions) with inverted population levels are investigated by means of kinetic theory. The interaction of three monochromatic waves which propagate parallel to the direction of a magnetic field in the medium are studied. Transverse as well as longitudinal waves are considered. The present paper, which represents a generalization of previous contributions to the subject, offers several new interesting processes of interaction, which may be basic to the description of phenomena occurring in astrophysics. Furthermore, it is of interest in connection with laboratory plasma and laser experiments. (auth)

31880 MAGNETOHYDRODYNAMIC WAVES IN A NON-UNIFORM CURRENT-CARRYING PLASMA COLUMN. Vaclavik, J.; Weise, E. (Univ. of Fribourg, Switzerland). J. Plasma Phys.; 12: No. 1, 61-69(Aug 1974).

An effect of an axial current on the propagation of low-frequency axisymmetric magnetohydrodynamic waves in a radially nonuniform plasma column was investigated theoretically and experimentally. It was found that the axial current and the density gradient cause a coupling between the torsional and compressional waves. (auth)

31881 MAGNETOPLASMA DISPERSION FUNCTION: SOME MATHEMATICAL PROPERTIES. Schmitt, J. P. M. (Ecole Polytechnique, Paris). J. Plasma Phys.; 12: No. 1, 51-59(Aug 1974).

The magnetoplasma dispersion function is defined as $f_\omega(z) = \omega/\sin(\omega) \int_0^\pi \cos(\omega\varphi) \exp(-z(1+\cos\varphi))\, d\varphi$. It is found in all the dispersion relations for wave propagation perpendicular to the magnetic field in hot plasmas. The properties of $f_\omega(z)$ are reviewed, and several new expansions, which may be of interest in the study of properties of waves in plasmas, or may suggest computational methods for calculating $f_\omega(z)$ are presented. (auth)

31882 GENERATION AND RADIATION OF SECOND HARMONIC BY S-POLARIZED ELECTROMAGNETIC WAVES INCIDENT ON A NARROW INHOMOGENEOUS PLASMA LAYER. Dologopolov, V. V.; El-Siragy, N. M.; Sayed, Y. A. (Atomic Energy Commission, Cairo). J. Plasma Phys.; 12: No. 1, 15-20 (Aug 1974).

Radiation of waves at double the frequency from an arbitrary inhomogeneous, isotropic plasma layer, is investigated, when s-polarized electromagnetic waves are obliquely incident on it and their lengths are considerably greater than the width of the layer. The amplitudes of the radiated waves are calculated. In general, it is shown that the second harmonics are radiated in the direction of propagation of both the reflected and the transmitted wave being at the basic frequency. At small plasma densities, the second harmonics are emitted practically only in the direction of propagation of the reflected wave at the basic frequency. For normal incidence, there is no wave radiation at double the frequency of the incident wave. (auth)

31883 EFFECT OF WAVE REFLECTION ON INDUCED RAMAN SCATTERING IN AN INHOMOGENEOUS PLASMA. Cairns, R. A. (Saint Andrews Univ., Eng.). J. Plasma Phys.; 12: No. 1, 169-174(Aug 1974).

The Raman backscatter instability produced by an electromagnetic wave in a plasma whose density increases in the direction of propagation is considered. It is shown that, when reflection of the waves involved in the interaction is taken into account, it may be possible to obtain, in the linear approximation, normal modes that grow exponentially in time. This is in contrast to the theory that neglects reflection, and focuses attention only on the region of resonant interaction, which predicts only spatial amplification. (auth)

31884 FORCE WAVES IN A NONISOTHERMIC RARIFIED PLASMA. Berezin, Yu. A.; Vshivkov, V. A. (Computer Center, Novosibirsk, USSR). Chislennye Metody Mekh. Sploshnoi Sredy; 3: No. 1, 3-16(1972). (In Russian).

The "large particles" method was used to study the propagation of large-amplitude waves in a nonisothermal plasma when the electron temperature exceeds markedly the ion temperature, as encountered under certain experimental conditions and in the solar wind plasma. In the model it was assumed that only the ionic component was in motion and the electron density followed the Boltzmann distribution, with the ion temperature equal to zero. The solution was presented in the form of an algorithm. (TTT)

31885 LONGITUDINAL OSCILLATIONS IN UNBOUNDED PLASMA. Khosa, P. N.; Singh, R. N. (Banaras Hindu Univ., India). Indian J. Phys.; 48: No. 2, 104-114(Feb 1974).

The perturbations in unbounded plasma result into longitudinal plasma oscillations. Various approximations result in different modes of oscillation and their frequencies are found to cover a wide range. The effect of bulk motion in the unbounded plasma was studied. The change in the dispersion properties of electron plasma, ion plasma, and ion-acoustic waves was computed. The role of various plasma modes was outlined and physical implications are discussed. (auth)

ENGINEERING

Energy Conversion

Refer also to abstract 31826.

31886 (CEA-N-1721) CREMATION BEHAVIOR IMPROVEMENT OF THE RADIOISOTOPE SOURCES FOR CARDIAC PACEMAKERS. Boucher, R.; Milet, C.; Quillico, J. J.; Van Craeynest, J. C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium). Apr 1974. 33p. (In French). Dep. NTIS (US Sales Only) $4.75.

The O.E.C.D. Nuclear Energy Agency has strengthened its specifications concerning the cremation test. The exposure time at 1300°C was raised from 30 to 90 minutes. When taken alone the ^{238}Pu source made of tantalum and platinum-iridium respectively withstands these test conditions but is damaged when inside a battery. The bismuth telluride (Te_3Bi_2) constituting the thermoelements attacks the outer platinum-iridium capsule of the source. Though a thin deposit of protective material could prevent the platinum capsule from Te_3Bi_2 attack, the tantalum capsule has been selected. (FR)

31887 (COO-2239-001) INVESTIGATION OF HIGH PERFORMANCE THERMAL INSULATION SYSTEMS. Final Report. Svedberg, R. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1974. Contract AT(11-1)-2239. 145p. (WANL-M-FR-004). Dep. NTIS $10.25.

The practicability of developing a relinble high-performance thermal insulation for a completely implantable nuclear powered artificial heart has been demonstrated. Vacuum multi-foil insulation technology has been refined; state-of-the-art advances in fabrication techniques and guarded heater thermal performance evaluations are reported. Concentric electroformed nickel cups have been utilized to eliminate high heat loss areas such as mitred corner joints and inter-layer compression resulting from the spiral wrap configuration previously constituting the state-of-the-art systems. Heat losses of 0.043 watts/cm^2 have been measured using only 20 concentric cups in a closed end-right circular cylinder configuration at 870°C. In addition, plasma spraying of ZrO_2 spacers has been evaluated along with other spacer fabrication techniques such as slurry painting, phosphate bonding and anodization of oxides on the foils. Plasma spraying ZrO_2 produced the most adherent spacer and promises to be the candidate technique for spacer application as insulation development continues. Outgassing and thermal evaluation studies were conducted on four state-of-the-art foil spiral wrapped insulation systems. The Nb–1Zr system exhibited no thermal degradation in a 300 h test at 870°C. The Ti system showed a substantial degradation in thermal performance during the same period at 870°C. However, the outgassing results demonstrated the capability of achieving a static vacuum for an extended period of time in a properly controlled and constructed vacuum multi-foil insulation system. (auth)

31888 (COO-3043-14) NUCLEAR-POWERED ARTIFICIAL HEART PROTOTYPE 3YSTEM DEVELOPMENT PROGRAM. Phase IIIA. Conceptual Design Intermediate System. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Feb 1974. Contract AT(11-1)-3043. 101p. Dep. NTIS $5.45.

The overall objective of Phase III is to develop the nuclear-powered Stirling-mechanical artificial heart system to prototype status. It is planned that the goals for the prototype system be achieved by incorporating improvements resulting from continuing research and development activities into a series of three calf-implantable systems: an implantable version of the Phase II bench model, the Intermediate System, and the Prototype System. A conceptual of the Intermediate System of Phase III is presented. (TFD)

31889 BASIS FOR COMPARATIVE COSTING OF IMPLANTABLE CARDIAC GENERATORS. Green, G. D. (Greater Glasgow Health Board). Chem. Ind. (London); No. 14, 562-565(20 Jul 1974).

A discussion is presented on the best method of costing of the many types of pacemakers that are commercially available. It is stated that although reliability is the most important factor with such instruments, relative costs are nevertheless an important factor. Purchase price should not be the main basis for comparisons; a better method may be to link the purchase price with the length of time a generator is implanted. The reliability of various types of implanted generators is discussed. Isotope powered generators are included in the discussion. (UK)

31890 TERMOELEKTRICHESKAYA ENERGETIKA. (Thermoelectric Power Engineering). Pozdnyakov, B. S.; Koptelov, E. A. Moscow; Atomizdat (1974). 264p.

The book describes the development history of the thermoelectric method for the direct conversion of thermal energy into electrical energy, and gives an engineering review of the state of this problem at present. The physics of thermoelectric phenomena is characterized, and methods of designing the thermoelements are described. A table of the characteristics of a large number of thermoelectric materials is presented. The essential construction details of thermoelectric batteries are indicated. A description is given of a number of concrete arrangements of thermoelectric generators which are based on solid, liquid, and gaseous fuels, on isotopic heat sources and nuclear reactors. (SJR)

31891 IMPROVEMENTS IN OR RELATING TO THERMOELECTRIC BATTERIES. Brown, M. H. (to United Kingdom Atomic Energy Authority). British Patent 1,351,630. 1 May 1974. 9p.

Reference is made to thermoelectric batteries, such as are used for cardiac pacemakers. The battery described comprises a casing that encloses a thermoelectric assembly consisting of a heat source, a heat sink, and a thermoelectric unit attached to and extending between the source and sink. The heat source end of the assembly forms an annular space with the casing. A heat conducting mass is located at the heat sink end of the assembly and attached to the casing, and spring means are provided so as to bias the heat sink into contact with the conducting mass. Adjacent surfaces of the sink and the conducting mass are formed so as to allow the heat source end of the assembly to move relative to the casing with a rocking motion so as to reduce the effects of acceleration forces. Stop means are provided to limit movement of the assembly relative to the casing. (UK)

Facilities and Equipment

Refer also to abstracts 31667, 32959, and 34471.

31892 (AD-773601) RESEARCH OF AEROPHYSICS INSTITUTE FOR STRATEGIC TECHNOLOGY. Semiannual Technical Summary for Period Ending 31 August 1973. Bloom, M. H. (Polytechnic Inst. of Brooklyn, N. Y. (USA)). 31 Aug 1973. Contract DAHC04-69-C-0077. 21p. (PIBAL-73-B; AROD-8677-41-P). NTIS $4.25.

A description is given of the technical problem areas and accomplishments achieved during the reporting period. The research projects are in the general subject areas of fluid dynamics, flow diagnostics, and laser development. (auth)

31893 (AD-775146) EMISSION SPECTRUM OF ELECTRO-IONIZED CO_2 LASERS. Basov, N. G.; Belenov, E. M.; Danilychev, V. A. 4 Feb 1974. Translation by R. A. Potts of pp 1-58 of Russian Preprint No. 58. (FTD-MT-24-767-73). 57p. NTIS $6.00.

31894 (AD-776541) ELECTROMAGNETIC FIELD IN A LASER RESONATOR. Interim Report, September 1972–September 1973. Carter, W. H. (Naval Research Lab., Washington, D. C. (USA)). 11 Mar 1974. 38p. (NRL-7663). NTIS $3.25.

A new theory was formulated whereby the electromagnetic field inside a resonator filled with an active medium is described through an expansion of the field into an angular spectrum of plane waves. The resonator is composed of two identical, circular reflectors of arbitrary size, focal length, and axial separation and contains an isotropic, homogeneous, saturable amplifying medium. This theory properly accounts for the vector properties of the field, is not limited by the usual paraxial approximations, and provides integral expressions for the spatial distribution of the field over the interior of the resonator in three dimensions. The expression for the transverse electric component of the field was evaluated numerically for several of the lower loss modes in confocal, spherical, and unstable resonators with linear dimensions the order of 10 wavelengths. These data indicate that some of the modes in confocal and spherical resonators are unstable, if the resonator has dimensions of a few wavelengths. The effect on the spatial distribution of the resonator field due to saturation of the amplifying medium is slight if spatial hole burning is neglected. The electromagnetic field given by this theory was also quantized, and the resulting formulation resembles the quantum theory for radiation in a closed resonator. (auth)

31895 (AD-776597) PLASMA CATHODE FOR E-BEAM LASERS. Semiannual Technical Report, 1 June–31 December 1973. Bayless, J. R. (Hughes Research Labs., Malibu, Calif. (USA)). Mar 1974. Contract N00014-72-C-0496. 44p. NTIS $3.25.

A new type of plasma cathode electron gun is described. This device employs a plasma generated within a low-voltage hollow cathode discharge rather than a thermionic emitter as the source of electrons. Electrons extracted from the plasma pass through a triode-type control grid structure and are accelerated to high energies in a plasma-free region prior to emerging from the gun through a thin foil window. The device is characterized by ruggedness, low cost, low power consumption, and fast response in comparison to thermionic cathode E-guns. (auth)

31896 (AD-776818) PHYSICAL PRINCIPLES, MATERIALS GUIDELINES, AND MATERIALS LISTS FOR HIGH-POWER 10.6 MICROMETER WINDOWS. Sparks, M. (Rand Corp., Santa Monica, Calif. (USA)). Sep 1973. Contract F44620-73-C-0011. 57p. NTIS $3.75.

No materials available when this research was performed were useful for 10.6-micron laser windows at the power levels and beam diameters of interest. Some available materials were too weak structurally, whereas others, strong enough, tended to distort the beam when they absorbed its heat. This report discusses the problems and the physical principles underlying them. It sets up guidelines for the search for, and the selection of, suitable materials. Then, by using these guidelines and the figures of merit already established, along with the known properties of a few materials, a narrow choice of materials is isolated for early experimental investigation. (auth)

31897 (AD-912102) PULSED METAL VAPOR LASERS. Quarterly Report on Phase 2. Karras, T. W.; Anderson, R. S.; Bricks, B. G.; Austin, W. E. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). Jul 1973. Contract N00014-73-C-0042. 16p. NTIS $4.00.

An attempt was made to demonstrate a bismuth vapor laser emitting at 4722 A. This involved some fundamental spectroscopic studies of bismuth and copper vapor discharges and a copper vapor laser. This goal also required substantial effort directed toward developing a fast risetime discharge in the bismuth vapor and improving the operation of the bismuth vapor generator. Finally, work was also done to extend the operating time of the quenching spark gaps at high repetition rates and power levels for application to the metal vapor lasers. (auth)

31898 (AED-CONF-72-616-004, pp 163-170) THE AIR AND WATER TIGHTNESS OF REINFORCED CONCRETE PLATES FLEXURAL LOAD. Steinert, J. 1972. (In German).

From meeting of the Schutzkommission beim Bundesministerium des Innern; Freiburg, F. R. Germany (12 May 1972).

With figs. Available for ZAED.

In Schutzkommission of the Federal Ministry of the Interior.

The water and air-tightness of reinforced concrete building components under flexural load decreases as a function of number, width and depth of the cracks being formed at the load face. The purpose of the present work was to determine the limiting value for the flexural rotation at which gas- and water-tightness reach their absolute, crucial limit. It is shown that water-tightness is certainly not dependent upon the flexural rotation, whereas the experiments on gas-tightness seem to indicate a linear relationship between permeability and flexural rotation. (GE)

31899 (AED-CONF-73-223-001) NEW CONSTRUCTION FOR HEAT EXCHANGERS AND STEAM GENERATORS. Beckmann, G.; Fritz, K.; Lippitsch, J. 1973. 3p. (In German). (CONF-730698-1).

From European meeting on chemical engineering and ACHEMA congress; Frankfurt am Main, F. R. Germany (20 Jun 1973).

31900 (BMFT-FB-T-73-02) NEW TYPE OF COOLING PROCESS FOR CONSTRUCTURAL UNITS OF POWER ELECTRONICS. Birnbreier, H.; Gammel, G.; Heidtmann, U.; Joens, M.; Pawlowski, P. (Bundesministerium fuer Forschung und Technologie, Bonn (F. R. Germany); Zentralstelle fuer Luft- und Raumfahrtdokumentation und -Information, Muenchen (F. R. Germany)). Apr 1973. 112p. (In German).

Maximum dimensions for the heat pipe cooler were calculated for a given heat flux capability. Technologies necessary for the construction of heat pipes have been developed, such as fabrication of capillary structures as well as the filling and sealing of heat pipes. Various samples of different design have been built and the influence of heat throughput, heat pipe position, and cooling air velocity on the heat resistance and the temperature distribution were experimentally determined. Also, the start up behavior of a heat pipe cooler was examined at room temperature and at temperatures below the freezing point of the working fluid. Corrosion tests performed so far have shown that the material combination of copper and water is suitable for heat pipe coolers within the desired temperature range and that prospective lifetimes can be reached. In comparison to a conventional cooler it is possible to double the heat flux with a heat pipe cooler, i.e., the maximum current load of a disc thyristor to be cooled at both sides with a direct current mean value of 500 A can be increased by 27%. (auth)

31901 (CEA-N-1701) DIFFERENT TYPES OF DAMAGE LEADING TO THE DESTRUCTION OF PRESSURE VESSELS. Roche, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service des Etudes Mecaniques et Thermiques). 14 Jan 1974. 24p. (In French). Dep. NTIS (US Sales Only) $4.25.

The development of new construction codes for pressurized apparatus must take into consideration the fact that the concept of stress can no longer be used as a limiting size criterion. It is necessary to concentrate on the different types of damage that can lead to the destruction of vessels, i.e., excessive deformation, plastic instability, elastic or elastoplastic instability, accumulated deformation, oligocyclic fatigue, and rupture. In the general case, the material used is sufficiently ductile to support plastic elongation without rupturing and very little is said about creep. (FR)

31902 (COM-74-10674/1) ACTIVE AND PASSIVE MODE LOCKING OF CONTINUOUSLY OPERATING RHODAMINE 5G DYE LASERS. Svavennec, A.; Nahman, N. S. (National Bureau of Standards, Boulder, Colo. (USA)). Feb 1974. 55p. (NBSIR-73-347). NTIS $5.75.

Using confined and unconfined fluid flow dye cells with suitable mode locking methods, continuously operating rhodamine 6G dye lasers were built to produce narrow pulses (less than 40 ps) at about a 140 MHz pulse repetition rate. For active (acoustic) amplitude modulation mode locking methods optical pulses were obtained having about a 32 ps pulse width (FWHM). For passive mode locking methods optical pulses of less than OR = 35 ps pulse width (FWHM) were obtained. A three mirror cavity was used for the active mode locking studies while three and five mirror cavities were used in the passive studies. The three mirror passive mode locked laser employed a single dye cell containing both the rhodamine 6G (gain) and dodci (loss) solutes in a single solution having glycol as the solvent. The active and passive mode locked carrier wavelengths were about 5900 A and 5800 A, respectively. (auth)

31903 (COM-74-10693/1) TUNABLE LASER SOURCE TECHNIQUES APPLIES TO THE ULTRAVIOLET SPECTRA OF NITROGEN OXIDES. Final Report, 1 April 1972–30 June 1973. Gallagher, J. J. (Georgia Inst. of Tech., Atlanta (USA). Engineering Experiment Station). 23 Aug 1973. 17p. (NOAA-74022702). NTIS $4.00.

Investigations were performed on techniques for the generation of tunable ultraviolet radiation for fluorescent spectroscopy of nitrogen oxide molecules. Dye lasers and the improvement of their power output were studied. Harmonic generation and nonlinear optical mixing schemes were considered. Amplification of the dye laser output and construction of various flashlamp configurations were studied. The features of nitrogen oxide spectra important to fluorescence observations are outlined. (auth)

31904 (HEDL-TME-74-14) SAMPLING, ANALYSIS, AND HANDLING OF SODIUM FOR THE HTSF. Yunker, W. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Mar 1974. Contract AT(45-1)-2170. 32p. AT.

The equipment and procedures used in sampling sodium for the High Temperature Sodium Facility are presented. Methods for analyzing the sodium and results obtained from the analyses are given. Various factors which may have affected the quality of the sodium are also summarized. (auth)

31905 (IRS-W-10) DESIGN OF NUCLEAR TECHNICAL INSTALLATIONS AGAINST EXTERNAL EFFECTS. Determination of the Penetration Depth of Projectiles and Projectile Fragments Into Multilayered Constructions. Drittler, K.; Gruner, P. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). Aug 1974. 25p. (In German). Dep. NTIS (US Sales Only) $4.25.

Applying half-empirical formulas which hold for the penetration of a projectile or of projectile debris into half-space, new formulas are derived for the penetration into bodies which are composed of material layers of various properties. Gravity and cracking at layer interfaces can be taken into account. Simple formulas are obtained in case the velocity dependence of the penetration into half-space is either of quadratic or of logarithmic form. A simple graphical method is presented which can be applied in case

gravity and cracking at layer interfaces need not be taken into consideration. (GE)

31906 (RT/ING-(74)16) MODEL REDUCTION AND IDENTIFICATION OF AN EXPERIMENTAL HEAT EXCHANGE LOOP. Abdel Malek, N.; Cianciolo, T. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jun 1974. 52p. Dep. NTIS (U. S. Sales Only) $5.75.

A modeling technique which considers the detailed mathematical model as a priori knowledge of the plant was used to obtain an equivalent and low order model efficient for small variations of the inputs in the neighborhood of the operating point. Input/output data obtained from deriving the detailed mathematical model are used to identify order and parameters of a simple dynamic model which can be corrected by using input/output actual data from the plant to minimize a quadratic chosen energy cost function. The simple dynamic model is assumed to be in canonical form, discrete time, time invariant, multivariable linear input/output model. A hybrid computer technique was used to implement the modeling technique to obtain an equivalent and low order model for the CSA-1 experimental heat exchange loop which is a part of the PRV project. (auth)

31907 (SAND-74-5207) PROSPECTS FOR X-RAY LASERS. Duguay, M. A. (Bell Labs., Murray Hill, N. J. (USA)). 1974. 16p. (CONF-740809-2). Dep. NTIS $4.00.

From 23rd annual conference on applications of x-ray analysis; Denver, Colorado, USA (7 Aug 1974).

A review is given of some approaches towards atomic x-ray lasers. Work in about half a dozen laboratories in the U. S. and Europe centers on the use of laser-produced plasmas to obtain inversion on atomic x-ray transitions. Much theoretical work is being done by the Soviets on a γ-ray or x-ray nuclear laser based on the Moessbauer effect. The Soviets estimate that their work might lead to a working device within 5 to 10 years. The laser plasma approach is described in some detail. (MOW)

31908 (SAND-74-5397) COMPUTATIONAL METHODS FOR STRESS WAVE PROPAGATION IN NONLINEAR SOLID MECHANICS. Herrmann, W.; Bertholf, L. D.; Thompson, S. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 54p. (CONF-740904-4). Dep. NTIS $5.75.

From 1st international conference on computational methods in nonlinear mechanics; Austin, Texas, USA (23 Sep 1974).

Numerical finite difference methods for the solution of stress wave problems in solid materials are discussed. Emphasis is placed on widely used Lagrangian and Eulerian methods for problems in two space dimensions. After a brief description of one particular representative computer program embodying each method, capabilities of the methods are illustrated by displaying a number of numerical solutions, and comparing them with exact and approximate analytical solutions, and with experimental results. (auth)

31909 (UCID-15365) ARGON LASER AND INTERFEROMETRIC FRINGE ENHANCEMENT. Gilson, V. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Sep 1968. Contract W-7405-eng-48. 9p. Dep. NTIS $4.00.

The potential use of the argon laser for mode matching with periodic FM discriminators is discussed. It is concluded that the laser will be useful for such purposes, but the permissible fringe mismatch error is more stringent than with the HeNe laser because of argon's broadband output. The advantages over the HeNe laser that may be realized by the argon laser are orders of magnitude more power available and effective laser cavity length greatly reduced with no loss of power. A disadvantage found with argon laser is obtaining a good reliable laser. (auth)

31910 (UCID-15700) CO_2 LASER PCM/FM SYSTEM WITH GIGABIT POTENTIAL. Jalbert, J. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1970. 46p. Dep. NTIS $5.50.

A description is given of efforts to study the feasibility of developing a plasma modulator for a CO_2 laser capable of gigahertz data rate modulation, to develop a stable laser system for performing optical communications experiments at 10.6 μ, and to recommend a direction for future studies in this field. (MOW)

31911 (UCID-16006) EFFECTS OF VARIOUS CHAIN-BRANCHING RATES ON THE PULSED hf CHEMICAL LASER. Rapagnani, N. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Mar 1972. Contract W-7405-eng-48. 35p. Dep. NTIS $4.75.

Chain-branching equations were added to a computer-simulated, pulsed HF chemical laser to determine their effect. The resulting increase in stored energy was found to be twice the increase obtained in the nonbranching case. The cold reactions pumping into HF(2) and the collisional deactivation of HF(v) by HF were found to be dominant populating/depopulating mechanisms for the [HF(2)-HF(1)] inversion. For the [HF(1)-HF(0)] inversion, the populating/depopulating mechanisms were controlled by vibrational deactivation of HF(v) by HF. For both the 2-1 and 1-0 inversions, P(3), P(4), and P(5) are the dominant P-branched transitions. (auth)

31912 (UCRL-75916) SELF-CALIBRATION AND ANALYSIS OF IMAGE FORMATION IN THE SUB-NANOSECOND DOMAIN. Weaver, H. J.; Sommargren, G. E.; Bliss, E. S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Aug 1974. 8p. (CONF-740823-6). Dep. NTIS $4.00.

From 18th annual meeting of the Society of Photo-Optical Instrumentation Engineers; San Diego, California, USA (19 Aug 1974).

The development of large high-powered laser systems for fusion research has placed new demands on the diagnostic analysis of laser beams. Such lasers often require specific and sophisticated analysis of both the temporal and spatial beam profiles at several stages throughout the chain. Both the volume of the diagnostic data and the sophistication of the analysis require that a high speed digital computer be used to perform this analysis. A computer code named PHOTOCAL has been written and is currently being used at Lawrence Livermore Laboratory to calibrate and analyze both the temporal and spatial profiles of sub-nanosecond laser pulses. A description of the code is given. (auth)

31913 (WASH-1332(74)(Vol.2), pp 699-703) DISPOSITION OF AEC RADIOACTIVELY CONTAMINATED FACILITIES. Glauberman, H. (Atomic Energy Commission, Washington, DC). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

The AEC has built many facilities at numerous sites throughout the country in carrying out its research and development, production, and related atomic energy programs. Many of these facilities have become radioactively contaminated due to the nature of their operations. As priorities or program emphasis changes within the AEC, the requirements for many of these sites and facilities also change. Upon completion or termination of a program, it is necessary to provide for safe disposition of these contaminated facilities. Until they are adequately decontaminated, it is necessary to maintain control over them so as to preclude inadvertent or unauthorized access or deterioration which could release and spread contamination. With the passage of time, deterioration of equipment and buildings, and the loss of experienced personnel familiar with the site and facilities, the disposition capability is greatly diminished and disposition operations become more difficult and expensive. Ultimately, it will be necessary to undertake the disposition of these facilities and sites to minimize, to the greatest extent practical, the number of sites which must remain under control as a result of their radioactive contamination and to return as much real property to unrestricted usage as possible. It is, therefore, necessary to assure that the decontamination and decommissioning of facilities that are no longer needed is carefully planned and undertaken to permit an appropriate disposition. During the last year, the Division of Waste Management and Transportation (WMT) was assigned the responsibility for the management and disposition of a number of radioactively contaminated AEC facilities. Criteria for the selection of facilities and preliminary plans are discussed. (CH)

31914 RECOMMENDED MINIMUM STANDARD SPECIFICATIONS FOR MANUALLY LEVER OPERATED HOISTS USING ROLLER OR LINK COIL CHAIN. Pittsburgh; Hoist Manufacturers Institute (1971). 6p. (ICONS-01815).

The specifications cover ratchet and pawl design, and load brake design manually lever operated hoists using a roller or link coil chain. (TFD)

31915 RECOMMENDED MINIMUM STANDARD SPECIFICATIONS FOR ELECTRIC CHAIN HOISTS. Pittsburgh; Hoist Manufacturers Institute (1971). 6p. (ICONS-01814).

The specifications cover lug, hook, and trolley suspended electric chain hoists. (TFD)

31916 RECOMMENDED MINIMUM STANDARD SPECIFICATIONS FOR ELECTRIC WIRE ROPE HOISTS. Pittsburgh; Hoist Manufacturers Institute (1971). 7p. (ICONS-01816).

The specifications cover lug, hook, and trolley suspended electric wire rope hoists. (TFD)

31917 BUTTERFLY VALVES. MSS Standard Practice SP-67. Arlington, VA; Manufacturers Standardization Society (1970). 7p. (ICONS-01799). $1.50.

This standard covers design and test performance for butterfly valves of the flowing types: (1) a tight shut-off valve which can be used for flow regulation and is tight in the closed position; (2) a low leakage valve which can be used for flow regulation and has leakage tolerances in the closed position; and (3) a nominal leakage valve which is used primarily for flow regulation (no seat test required). (TFD)

31918 SPECIFICATIONS FOR ELECTRIC OVERHEAD TRAVELING CRANES. C.M.A.A. Specification No. 70. Pittsburgh; Crane Manufacturers Association of America, Inc. (1971). 55p. (ICONS-01817).

This specification has been developed by an organization of leading electric overhead traveling crane manufacturers of the United States for the purpose of promoting standardization and providing a basis for uniform quality and performance. The use of this specification should not limit the ingenuity of the individual manufacturer but should provide guide lines for economical procedure. In addition to specifications, the publication contains information which should be helpful to the purchasers and users of cranes and to the engineering and architectural professions. While much of this information must be of a general nature, the items listed may be checked with individual manufacturers and comparisons made leading to optimum selection of equipment. (auth)

31919 BYPASS AND DRAIN CONNECTION STANDARD. MSS Standard Practice SP-45. Arlington, VA; Manufacturers Standardization Society (1971). 8p. (ICONS-00194). $1.50.

This standard practice, for valve and fitting drains regardless of material or pressure; and fabricated bypasses for ferrous valves for all pressures wherever a bypass is required, covers: (a) standard symbols and locations of openings for drains and bypasses, (b) standard size of drains and bypass openings, (c) minimum thread lengths in drain and bypass tappings, (d) minimum diameter and depth of socketweld connection for drain and bypass, (e) butt-welding connection for drain and bypass, (f) bosses for drain and bypass connection, and (g) method of designating outlets of reducing fittings. (TFD)

31920 SILVER BRAZING JOINTS FOR WROUGHT AND CAST SOLDER JOINT FITTINGS. MSS Standard Practice SP-73. Arlington, VA; Manufacturers Standardization Society (1970). 3p. (ICONS-01803). $1.50.

This standard covers solder joint fittings for application by silver brazing into a piping system with BAg or BCup brazing materials. (TFD)

31921 CONNECTING FLANGE JOINT BETWEEN TAPPING SLEEVES AND TAPPING VALVES. MSS Standard Practice SP-60. Arlington, VA; Manufacturers Standardization Society (1969). 2p. (ICONS-01798). $1.00.

This standard covers the dimensions of the positioning recess and mating raised face of the connecting flanges between tapping sleeves and tapping valves. This recess in the sleeve and raised face on the valve serves to insure proper alignment of the valve on the tapping sleeve but does not affect either strength or tightness of the joint. The standard covers dimensions for flanges of nominal sizes from 2 in. to 12 in. Diameter and drilling of flanges shall conform to the requirements of USA Standard B16.1- 1967– Cast Iron Flanges and Flanged Fittings, 125 lbs. Tapping sleeves and tapping valves designed for use at pressures higher than those permitted in USA B16.1 are not included in this standard. (auth)

31922 CAST IRON GATE VALVES, FLANGED AND THREADED ENDS. MSS Standard Practice SP-70. Arlington, VA; Manufacturers Standardization Society (1970). 10p. (ICONS-01800). $2.00.

This standard practice covers full ported cast iron gate valves with flanged or threaded ends. These valves are suitable for general purpose use. (TFD)

31923 CAST IRON SWING CHECK VALVES, FLANGED AND THREADED ENDS. MSS Standard Practice SP-71. Arlington, VA; Manufacturers Standardization Society (1970). 6p. (ICONS-01801). $1.50.

This standard practice covers cast iron swing check valves with flanged and threaded ends for general purpose use in essentially horizontal lines. (TFD)

31924 BALL VALVES WITH FLANGED OR BUTT-WELDING ENDS FOR GENERAL SERVICE. MSS Standard Practice SP-72. Arlington, VA; Manufacturers Standardization Society (1970). 10p. (ICONS-01802). $2.00.

This standard covers round opening, full or nominal bore, metal body, ball valves of either flanged end or butt-welding end type. The valves are suitable for use in general liquid and gas services. (TFD)

31925 MICROWAVE MODULATION OF CO_2 LASERS IN GaAs OPTICAL WAVEGUIDES. Cheo, P. K.; Gilden, M. (United Aircraft Research Labs., East Hartford, CT). Appl. Phys. Lett.; 25: No. 5, 272-274(1 Sep 1974).

Sideband power was generated at frequencies offset approximately 10 GHz from a CO_2 laser line, P(20)00°1–10°0, in a thin slab of GaAs. Efficient nonlinear interaction was accomplished by having the thin slab serve as both an optical waveguide and a microwave minigap ridge waveguide. With a 20-W microwave signal applied to a 30-μm-thick optical waveguide contained in a 0.9-cm-long ridge section, about 0.4% laser power has been transferred into the sidebands, consistent with the theory. (auth)

31926 MULTI-KILOJOULE HF LASER USING INTENSE-ELECTRON-BEAM INITIATION OF H_2-F_2 MIXTURES. Gerber, R. A. (Sandia Labs., Albuquerque, NM); Patterson, E. L.; Blair, L. S.; Greiner, N. R. Appl. Phys. Lett.; 25: No. 5, 281-283 (1 Sep 1974).

A HF-laser experiment is described in which an intense electron beam was used to initiate high-pressure room-temperature H_2/F_2 mixtures. The maximum laser energy was 2.3 kJ in a 35-nsec (FWHM) pulse with a mixture of 360-torr F_2, 140-torr O_2, 100-torr SF_6, and 100-torr H_2. Electrical efficiency for the laser was as high as 200%. The maximum chemical efficiency was 5.2%. (auth)

31927 SPACE AND TIME RESOLVED GAIN MEASUREMENTS OF A UV-SUSTAINED CO_2 LASER. Clark, W. M. Jr.; Lind, R. C. (Hughes Research Labs., Malibu, CA). Appl. Phys. Lett.; 25: No. 5, 284-286(1 Sep 1974).

Laser gain measurements at 10.6 μm are presented for a 2.5 × 5 × 50-cm high-pressure uv-sustained discharge in a $CO_2 : N_2 :$ He : tri-n-propylamine gas mixture. The spatial variation of the gain, with a resolution of a 1.5-mm-diam spot, is discussed. The temporal behavior of the gain is shown to be influenced by the uv-induced photoionization, an acoustical disturbance generated by the uv source arcs, and by photoemission and collisional ionization effects near the solid electrode. (auth)

31928 GaAs–$Al_xGa_{1-x}As$ DOUBLE-HETEROSTRUCTURE LASERS PREPARED BY MOLECULAR-BEAM EPITAXY. Cho, A. Y.; Casey, H. C. Jr. (Bell Labs., Murray Hill, NJ). Appl. Phys. Lett.; 25: No. 5, 288-290(1 Sep 1974).

GaAs–$Al_xGa_{1-x}As$ double-heterostructure (DH) lasers that exhibit laser properties similar to DH lasers prepared by liquid-phase epitaxy were prepared by molecular-beam epitaxy. For a structure with a 0.53-μ-thick active layer, the as-grown threshold current density at room temperature was 3.5×10^4 A/cm^2, but by annealing the threshold was reduced to 4.0×10^3 A/cm^2. (auth)

31929 USE OF ELECTRON BACKSCATTERING FOR SMOOTHING THE DISCHARGE IN ELECTRON-BEAM-CONTROLLED LASERS: COMPUTATIONS. Smith, R. C. (Westinghouse Research Labs., Pittsburgh). Appl. Phys. Lett.; 25: No. 5, 292-295(1 Sep 1974).

The anode material in an electron-beam-controlled gas laser strongly influences the uniformity of the sustainer discharge, because the backscattering of the beam electrons from the anode is different for different atomic numbers. As a result of switching from aluminum to, for instance, uranium, there is a 60% increase in the ionization near the anode, according to Monte Carlo computations for a typical planar laser configuration. This effect can cause a 30 to 60% drop in the local electric field, depending upon the field dependence of the electron-ion recombination coefficient. As an example for studying this effect, we have considered a 150-keV beam passing through an 0.8-mil Ti window into a 26-cm-wide planar cavity containing a 3 : 2 : 1 mixture of He, CO_2, and N_2 at 1 atm and 293°K, with $E_{avc} = 4.5$ kV/cm. Window power loading, electron attenuation, electron energy distributions, and sustainer field distributions were calculated for the two different anode materials. (auth)

31930 UNSTABLE-RESONATOR FLASHLAMP-PUMPED DYE LASER. Ewanizky, T. F. (Army Electronics Command, Fort Monmouth, NJ). Appl. Phys. Lett.; 25: No. 5, 295-297 (1 Sep 1974).

A negative-branch confocal unstable resonator was found to significantly improve the beam quality of a coaxial flashlamp-pumped rhodamine 6G dye laser. In a performance comparison with a conventional parallel-plane mirror resonator, over an order-of-magnitude increase in laser beam radiance was measured. The negative-branch unstable resonator demonstrated relatively uncritical alignment sensitivity. (auth)

31931 GENERATION AND DETECTION OF 150-PSEC MODE-LOCKED PULSES FROM A MULTI-ATMOSPHERE CO_2 LASER.

Alcock, A. J.; Walker, A. C. (National Research Council of Canada, Ottawa). Appl. Phys. Lett.; 25: No. 5, 299-301(1 Sep 1974).

Mode-locked operation of a uv-preionized TE CO_2 laser was investigated at pressures in the 10 to 15 atm range. By upconverting the output to 0.96 μm and recording it with a streak camera it was shown that pulses of duration less than 150 psec can be generated using p-type Ge saturable absorbers. (auth)

31932 GENERATION OF SUBNANOSECOND CO_2 LASER PULSES AT 10.6 μm BY PULSE COMPRESSION TECHNIQUES. Feldman, B. J.; Figueira, J. F. (Los Alamos Scientific Lab., NM). Appl. Phys. Lett.; 25: No. 5, 301-303(1 Sep 1974).

The results of an investigation of the time evolution of a mode-locked pulse produced by a CO_2 laser passively mode locked with an In-doped Ge bleachable absorber are presented. The observed pulse shortening is explained by a simple theory of pulse compression due to the saturable absorber. Pulse durations as short as 400 ps are observed. (auth)

31933 GIGAHERTZ TUNABLE WAVEGUIDE CO_2 LASER. Abrams, R. L. (Hughes Research Labs., Malibu, CA). Appl. Phys. Lett.; 25: No. 5, 304-306(1 Sep 1974).

A sealed-off cw waveguide CO_2 laser has been continuously tuned over 1.2 GHz on a single transition at 10.6 μm. The laser consists of a 9.5 cm × 1.0 mm square discharge tube fabricated from polished BeO slabs. Line selection is achieved with a diffraction grating and tuning is accomplished by piezoelectric control of the resonator length. (auth)

31934 TRAVELING-WAVE GAS LASER. Faxvog, F. R.; Gara, A. D. (General Motors Corp., Warren, MI). Appl. Phys. Lett.; 25: No. 5, 306-308(1 Sep 1974).

The ratio of the clockwise to counterclockwise intensities in a multimode He–Ne ring laser was measured as the strength of unidirectional coupling between the two intensities was varied. These results are compared to calculations based on a gain saturation with field coupling model which indicates that intensity ratios $>10^2$ are possible. With the addition of an etalon in the laser cavity, stable single-mode operation is observed. (auth)

31935 TUNABLE DYE LASER PULSE CONVERTER FOR PRODUCTION OF PICOSECOND PULSES. Chan, C. K.; Sari, S. O. (Massachusetts Inst. of Tech., Cambridge). Appl. Phys. Lett.; 25: No. 7, 403-406(1 Oct 1974).

An open flowing Rh6G dye laser, cavity length tuned to a mode-locked Ar^+ laser, was used to generate continuous pulse trains tunable from 5600 to 6100 Å over the dye lasing bandwidth. Interferometric pulse-width measurement using second harmonic generation yields a pulse width of 2.8 ps. (auth)

31936 CALCULATIONS FOR CO_2 GAS-DYNAMIC LASERS. I. Gain Coefficient. Krasitskaya, L. S.; Napartovich, A. P.; Sharkov, V. F. (Inst. of Atomic Energy, Moscow). High Temp. (USSR) (Engl. Transl.); 11: No. 6, 1033-1038(1973).

Translated from Teplofiz. Vys. Temp.; 11: No. 6, 1155-1161 (1973).

The problem of finding the gain coefficient of a carbon dioxide gas-dynamic laser is considered. A simplified method of calculation is proposed which works well in the range of basic parameters of practical importance. There is a qualitative discussion of the problem. The results of the calculations are shown in graphical form. (auth)

31937 IMPROVEMENTS IN OR RELATING TO FLOW MEASURING DEVICES. Walton, H. (to United Kingdom Atomic Energy Authority). British Patent 1,353, 299. 15 May 1974. 6p.

The device described employs a member supported on cantilever beams so as to be deflected by flow over or through it, with means for measuring the deflection comprising a capacitive transducer consisting of two capacitors at least one of which is variable in accordance with the deflection being measured. The capacitors are connected into two arms of a four arm electrical network. Two charge amplifiers are connected into the other two arms of the network. An ac carrier input signal is applied across the junction between the capacitors and the common junction of the charge amplifiers, and means are provided for obtaining a signal dependent on the difference between the outputs of the charge amplifiers, with means for demodulating the signal to give an output representative of the deflection. The member supported on the cantilever beams may comprise a mesh or grid arranged to cover a complete flow area of the device. The flow meter is claimed to have high sensitivity and to be suitable for use in flow circuits of nuclear reactors. See also BP 1340703. (UK)

31938 LASER SPECTRUM SELECTION WITH TELESCOPIC RESONATORS. Lyubimov, V. V.; Medvedev, S. K.; Orlova, I. B.; Petrov, V. F. Opt. Spectrosc. (USSR) (Engl. Transl.); 36: No. 4, 469-470(Apr 1974).

Translated from Opt. Spectrosk.; 36: No. 4, 806-808(Apr 1974).

The possibility of spectral selection of radiation in the most general case of a neodymium glass laser with a telescopic resonator with spherical mirrors was studied. A number of Fabry–Perot interferometer schemes with telescopic resonators are given. It is shown that under certain conditions introduction of the interferometer in the resonator does not noticeably change the intensity distribution over the end and the energy of laser radiation. (MOW)

31939 INTERFEROMETRIC MEASUREMENTS OF THE LINE-WIDTHS OF THE EMISSION OF A PULSED PbSe INJECTION LASER. Agelkin, V. A.; Zasavitskii, I. I.; Koloshnikov, V. G.; Likhter, A. I.; Pel, E. G.; Shotov, A. P. Opt. Spectrosc. (USSR) (Engl. Trans.); 36: No. 4, 471-472(Apr 1974).

Translated from Opt. Spectrosk.; 36: No. 4, 808-811(Apr 1974).

Integral line width measurements were made of the emission of a PbSe injection laser using a Fabry–Perot scanning interferometer in the infrared band. The arrangement used for the measurements is described. Diagrams showing the shape of the line of the emission of the PbSe laser for two values of the injection current density are given. (MOW)

31940 UNSYNCHRONIZED TWO-MODE LASING IN A GAS RING LASER. Sokolov, V. A.; Fradkin, E. E. Opt. Spectrosc. (USSR) (Engl. Transl.); 36: No. 3, 348-349(Mar 1974).

Translated from Opt. Spektrosk.; 36: No. 3, 603-605(Mar 1974).

An optical ring laser, in which two orthogonal, linearly polarized modes are excited, was studied. A gaseous mixture with an equal-isotope composition was the active medium. One of the modes was polarized along the x direction, the other along the y direction. Equations are given for the four-wave unsynchronized regime. A diagram of frequency as a function of mode position in the gain profile is given. (MOW)

31941 OPTICHESKOE KOGERENTNOE IZLUCHENIE. (Optical Coherent Radiation). D'yakov, V. A.; Tarasov, L. V. Moscow; Sovetskoe Radio (1974). 168p.

Consideration is given to coherentness in optics, lasers as sources of coherent optical radiation, nonlinear phenomena in the optical region, modulation and receiving of optical radiation, optical channels of information transmission, optical two-dimensional signals, optical systems of handling information, spacial filtration and methods of optical holography. The book can be considered as an introduction to radio-optics. (SJR)

31942 NITROGEN LASER WITH A THYRATRON POWER SUPPLY SYSTEM. Tarasenko, V. F. (Inst. of Atmospheric Optics, Tomsk, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 1, 197-199(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 1, 172-174(1974).

The possibility of connecting a thyratron into the power supply system of a nitrogen laser based on strip lines with a transverse discharge was investigated. For an active length of 15 cm a power of 70 kW is obtained at λ = 3371 Å. The dependences of the radiation power on pressure and on the capacitance of the strip lines of the power supply system are presented. It is shown that when the effect of the side walls of the laser chamber is eliminated the radiation power is uniformly distributed over the area of the output beam. (auth)

31943 STANDARD FINISHES FOR CONTACT FACES OF PIPE FLANGES AND CONNECTING END FLANGES OF VALVES AND FITTINGS. MSS Standard Practice SP-6. Arlington, VA; Manufacturers Standardization Society (1974). 3p. (ICONS-00189). $2.00.

This standard pertains to the finish of gasket contact faces of pipe flanges and end flanges of valves and fittings. It is intended for application to products covered by ANSI B16 Standards for those instances where they do not contain complete facing finish requirements. (auth)

31944 WROUGHT STAINLESS STEEL BUTT-WELDING FITTINGS: INCLUDING REFERENCE TO OTHER CORROSION RESISTANT MATERIALS. MSS Standard Practice SP-43. Arlington, VA; Manufacturers Standardization Society (1971). 10p. (ICONS-00193). $2.00.

ANSI B16.9 is the American Standard for steel butt-welding fittings and although not so stated, it is implied that its scope deals primarily with the schedules of wall thicknesses which are common to carbon steel and the grades of alloy steel piping that are selected for pressure and temperature considerations. The purpose of this standard is to provide industry with a set of dimensional standards for butt-welding fittings that can be

used with these light wall pipes of corrosion resisting materials. The center-to-end dimensions of all fittings are identical with those in ANSI B16.9 which give to industry the advantage of uniform design room practice and a maximum utilization of existing die equipment. The only departure from this is in the lap-joint stub end where for purposes of economy the face-to-end of the product has been reduced for use with thin wall piping. (TFD)

31945 MALLEABLE IRON THREADED PIPE UNIONS 150, 250, AND 300 LBS. MSS Standard Practice SP-76. Arlington, VA; Manufacturers Standardization Society (1970). 7p. (ICONS-01804). $1.50.

This standard practice provides requirements for the type, pressure–temperature ratings, size, marking, materials, joints and seats, threads, hydrostatic strength, tensile strength, air pressure test, sampling, coatings, and dimensions of 150, 250, and 300 lb threaded malleable iron unions. (TFD)

31946 GENERATION AND APPLICATIONS OF PASSIVELY MODE-LOCKED PICOSECOND LIGHT PULSES. Laubereau, A.; Kaiser, W. (Technische Univ., Munich, Ger.). Opto-Electronics; 6: No. 1, 1-24(Jan 1974).

A model concerning the generation of picosecond light pulses in solid state lasers is compared with existing experimental observations. The quality of selected single pulses and their favorable properties for investigations with ultrashort light pulses are discussed. Extensive physical applications of picosecond light pulses are reviewed. Emphasis is given to quantitative investigations of nonlinear optics and of ultrafast relaxation processes in condensed matter. (auth)

31947 GENERATION AND MEASUREMENT OF FREQUENCY-TUNABLE PICOSECOND PULSES FROM DYE LASERS. Bradley, D. J. (Imperial Coll. of Science and Tech., London). Opto-Electronics; 6: No. 1, 25-42(Jan 1974).

Experimental techniques for the generation of frequency-tunable picosecond pulses from passively mode-locked dye lasers are reviewed. Direct photoelectric measurements of pulse durations with a streak-camera of time resolution <3 ps are described. Recent studies of the build-up of pulse shortening and of saturable absorber photochemistry are discussed and related to the mode-locking processes in dye lasers. (auth)

31948 ACTIVE MODE-COUPLING PHENOMENA IN PULSED AND CONTINUOUS LASERS. Siegman, A. E.; Kuizenga, D. J. (Stanford Univ., CA). Opto-Electronics; 6: No. 1, 43-66(Jan 1974).

An optical modulator inside a laser cavity, if driven at the cavity c/2L frequency or a harmonic, will produce a variety of mode-coupled short-pulse and FM-laser phenomena. This paper reviews the kinds of cw and transient mode-coupling phenomena that can occur in cw lasers and in selected lower-power lasers using either an active optical modulator or in some cases passive saturable absorbers. (auth)

31949 EFFECT OF SELF-PHASE MODULATION ON THE EVOLUTION OF PICOSECOND PULSES IN A Nd:GLASS LASER. Eckardt, R. C.; Lee, C. H.; Bradford, J. N. (Naval Research Lab., Washington, DC). Opto-Electronics; 6: No. 1, 67-85(Jan 1974).

Time-resolved spectrograms are presented; covering pulse development from $1/_{50}$ peak intensity, where the pulse is well mode-locked, to full development, where spectral structure is complex. A numerical analysis, including self-phase modulation, non-linear absorption, amplification and dispersion, yields results that qualitatively agree very well with the experimental records, suggesting that self-phase modulation plays an important role in the evolution of mode-locked pulses in a Nd:glass laser. (auth)

31950 MODE-LOCKED CW DYE LASERS. Dienes, A. (Univ. of California, CA). Opto-Electronics; 6: No. 1, 99-113 (Jan 1974).

Mode-locking of cw dye lasers are described. Three different methods: active mode-locking by acoustic loss modulation, pumping with mode-locked pulses and passive mode-locking by a saturable absorber, all resulted in stable continuous trains of tunable mode-locked pulses of various duration. Best results were obtained using passive mode-locking by a saturable absorber. The pulse lengths for this case were measured by auto-correlation technique to be as short as 1.5 ps. Factors influencing the mode-locking and possible improvements are discussed. (auth)

31951 KINETICS OF PHYSICAL PROCESSES IN LASERS WITH PINCH-DISCHARGE. Reshetnyak, S. A.; Shelepin, L. A. Zashch. Pokrytiya Metal.; No. 4, 14-21(1974). (In Russian).

The kinetics of physical processes in lasers on pinch-discharge was investigated. An analytical solution is proposed for solving the problem of relaxing the populations of discrete levels of ionized argon (Ar II) during fast compression of a high-temperature, nonequilibrium plasma. On the basis of resolving and also simplifying the compression model of a plasma loop an expression was obtained for the inverse population as a function of plasma and equipment parameters. Basic experimental dependencies for lasers in pinches are analyzed. (SJR)

Heat Transfer and Fluid Flow

Refer also to abstracts 31899, 31900, 31906, 32774, 34127, 34227, 34228, 34234, 34344, 34367, 34376, and 34387.

31952 (AED-CONF-73-223-017) REACTIONS FOLLOWING A SUDDEN PRESSURE DROP IN A CONTAINER FILLED WITH BOILING WATER OR SUBCOOLED WATER. Ruediger, B. 1973. 1p. (In German). (CONF-730698-12).

From European meeting on chemical engineering and ACHEMA congress; Frankfurt am Main, F. R. Germany (20 Jun 1973).

31953 (CLM-R-134) SPARK-GENERATED STEAM BUBBLES (EXPERIMENT AND THEORY). Adlam, J. H.; Dullforce, T. A. (UKAEA Research Group, Abingdon. Culham Lab.). Mar 1974. 19p. Dep. NTIS (US Sales Only) $4.00. UK 50 pence.

Sparks in water were produced by discharging a charged condenser through a spark gap using an ignitron circuit. Steam bubbles with a maximum radius ≈1 cm were obtained. A fast cine-camera was used to observe the bubble and a pressure transducer was used to measure pressure variations in the water. A simple computer program similar to that described by Judd (UKAEA Reports AEEW-M792(1966) and AEEW-M813(1968)) has been developed to calculate the bubble dynamics. (auth)

31954 (CONF-730465–(P1)) PROCEEDINGS OF INTERNATIONAL SYMPOSIUM ON VIBRATION PROBLEMS IN INDUSTRY, KESWICK, ENGLAND, 10–12 APRIL 1973. Session 1. Weightman, P. (ed.). (UKAEA Reactor Group, Sellafield; National Physical Lab., Teddington (UK)). 1973. 283p. Dep. NTIS (US Sales Only)$17.25.

Thirteen papers are presented concerning basic fluid dynamics and structural response. (DCC)

31955 (KFK-1891) EKAPPA–A COMPUTER PROGRAM FOR THE CALCULATION OF THE STEAM ISENTROPE EXPONENTS. Analysis and Program Description. Harten, U.; Ziegler, H. J. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorbauelemente). Dec 1973. 46p. (In German). INIS.

4 figs.; 6 refs. With abstract in English and German.

This work aims at establishing an easily manageable computing program which helps to compute the isentrope exponent of steam in the wet and superheated steam state. The mathematical-numerical method used is based upon thermodynamic correlations which describe the isentrope exponent. The computing program called EKAPPA allows for the following requirements: (1) adequate accuracy of the computed isentrope exponent in the superheated and wet steam state within the limits of the requirements of accuracy as contained in the VDI tables for water and steam. (2) Compatibility of the dimensions of the parameters used with the already existing programs. (auth)

31956 (KFK-2007) DYNAMIC MODEL OF THE FORMATION OF HETEROGENEOUS COLLECTIVE BOILING NUCLEI. Class, G. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung). Jul 1974. 45p. (In German). INIS.

8 figs.; 19 refs. With abstract in German and English.

It is shown that the properties of boiling nuclei essential for the formation of heterogeneous boiling nuclei can be derived from the properties of the interfaces and the three-phase boundary line. Following a discussion of the wettability of solids by liquids and the associated wetting angles, details are given on the wetting angle hysteresis. At the same time, referring to a briefly reported experiment, the phenomenon of boundary line creep is demonstrated; the anticipated boundary line creep rates in the order of 10^{-5} mm/sec are made responsible for the dynamic behavior of boiling nuclei (waiting time effect and related phenomena). Probable forms of boiling nuclei and their physicochemical conditions are discussed. Finally a statistical dynamic model is outlined. It described the formation of heterogeneous boiling nuclei in a collective of latent boiling nuclei. On the basis of simple models, a quantitatively usable formulation is presented for the expected distribution functions for the boiling probability as a function of superheat, time, and system parameters. This

simplified model of computation is evaluated numerically and the results are discussed with respect to the applicability to experimental data. Based on this computational model it should be possible to obtain preliminary insights into the physicochemical events which take place at the interface and which are relevant to boiling nuclei. Results from this model can be used to successively improve the models of boiling nuclei. (auth)

31957 (RT/ING-(74)12) MEASUREMENT OF THE VOID FRACTION IN AIR–WATER ADIABATIC FLOW IN A LARGE-DIAMETER PIPE. Lupoli, P.; Muzzio, A.; Sotgia, G. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Mar 1974. 45p. (In Italian). (CONF-730665-3). Dep. NTIS (US Sales Only) $5.25.

From European two phase flow group meeting; Brussels, Belgium (4 Jun 1973).

Void fraction determination in two-phase adiabatic flows into a large diameter duct (ϕ_i = 220 mm) is described. The experimental facility employed is a natural circulation loop working with air and water, at ambient temperature. Void fraction measurements were carried out for mass velocity values ranging from 20 g/cm^{2}sec to 150 g/cm^{2}sec and input volume void fraction ranging from 0.4 to 0.9. It was found that small columns exhibit higher gas hold-up than large diameter columns, with the same conditions of gas and liquid superficial velocity. A procedure was developed which made possible the determination of the local void fraction distribution across the duct's cross section. (auth)

31958 SOME CRITICAL PHENOMENA IN TWO-PHASE FLOWS. Romanovskii, I. M.; Styrikovich, M. A.; Nevstrueva, E. I. (Inst. of High Temperatures, Moscow). High Temp. (USSR) (Engl. Transl.); 11: No. 5, 929-934(1973).

Translated from Teplofiz. Vys. Temp.; 11: No. 5, 1044-1050 (1973).

It is shown that the type of boiling crisis which arises in two-phase flows depends on the hydrodynamic structure of the flow. The true volumetric vapor content and not the thermal load is the parameter determining a crisis of the first kind. It is shown that the decisive role in the heat-transfer crisis is played not by the vapor but by the liquid phase and its properties. When the reduced weight of the liquid becomes less than 1.2 kg/m^2, "bubble" boiling becomes impossible. It is shown that in the boiling of solutions the intensity of the mass transfer of the liquid phase between the core of the flow and the boundary layer falls sharply for a salt content above critical. An analogy is established between the heat and mass transfer of the liquid phase and the boiling hydrodynamics. (auth)

31959 CORRELATION FOR EVALUATING PRESSURE DROPS THROUGH THE PACKING OF COUNTERFLOW WET NATURAL-DRAUGHT COOLING TOWERS. Cavanna, A.; Folli, E. (CISE, Milan). Energ. Nucl. (Milan); 21: No. 8-9, 495-503(1974). (In Italian).

A correlation concerning the pressure drops through the packing of counterflow wet natural-draught cooling towers is presented. This correlation was formulated on the basis of the experimental results relevant to a small-scale model, in which the main packing types currently employed were tested. The comparison between this correlation and experimental results is satisfactory, especially if the inaccuracy which affects the experimental values is taken into account; moreover, the insertion of this correlation into a wider calculation program for thermal-hydraulic design of full-scale cooling towers gave fully satisfactory results. (auth)

Materials Testing

31960 (AD-774904) SELECTION AND DEMONSTRATION OF ADVANCED NONDESTRUCTIVE TESTING TECHNIQUES FOR ON-SITE MISSILE INSPECTION. Volume I. Technical Report. Final Report, 15 May 1972–14 September 1973. Briar, H. P.; Bills, K. W. Jr.; Cribbs, R. W.; Lamb, B. L. (Aerojet Solid Propulsion Co., Sacramento, Calif. (USA)). 1973. 172p. (ASPC-1963-26F-Vol.1; AFRPL-TR-73-91-Vol.1). NTIS $11.75.

The program was planned around the problem of on-site nondestructive testing (NDT) of solid rocket motors. It was designed to select, evaluate, and demonstrate NDT capabilities, beginning with comprehensive surveys of industry and the world's literature (from 1960 to mid-1972). Many materials and NDT devices were identified; most of these being ruled out by the constrainte of in-silo testing. Only two techniques showed promise, i.e., ultrasonic holography and gamma radiography. (auth) (GRA)

31961 (AD-774905) SELECTION AND DEMONSTRATION OF ADVANCED NONDESTRUCTIVE TESTING TECHNIQUES FOR ON-SITE MISSILE INSPECTION. Volume II. Appendices. Final Report, 15 May 1972–14 September 1973. Briar, H. P.; Bills, K. W. Jr.; Cribbs, R. W.; Lamb, B. L. (Aerojet Solid Propulsion Co., Sacramento, Calif. (USA)). Nov 1973. 168p. (ASPC-1963-26F-Vol.2; AFRPL-TR-73-91-Vol.2). NTIS $11.50.

The report describes a program planned around the problem of on-site nondestructive testing (NDT) of solid rocket motors. It was designed to select, evaluate, and demonstrate NDT capabilities, beginning with comprehensive surveys of industry and the world's literature (from 1960 to mid-1972). Only two techniques showed promise: ultrasonic holography and gamma radiography. In the ensuing developments ASPC evaluated two ultrasonic systems. The first, modified ultrasonic holography, was developed from known principals of holography and ultrasound transmission through materials. The theoretical resolution of this system ranges between 0.4 in. and 1 in. at a depth of 18 in. into the propellant. The second system, acoustic profilography, uses the principle of diffraction to measure the shortest path across a secant of the motor. (auth)

31962 (AED-CONF-73-223-014) RECENT NEW FINDINGS IN THE NONDESTRUCTIVE, RADIOMETRIC-ELECTRONIC MEASUREMENT OF COATING THICKNESS. Ott, A. 1973. 2p. (In German). (CONF-730698-9).

From European meeting on chemical engineering and ACHEMA congress; Frankfurt am Main, F. R. Germany (20 Jun 1973).

31963 (EURISOTOP-79) WELD SEAM TESTING IN THE CONSTRUCTION OF LONG PIPELINES WITH THE SELF-PROPELLING ISOTOPE CRAWLER. Sauerwein, K. (Commission of the European Communities, Brussels (Belgium). Bureau Eurisotop). Mar 1974. 25p. (In German). Dep. NTIS (US Sales Only) $4.25.

Pipelines under construction require continuous radiographic testing of girth welded seams as building progresses. Since conventional, manually-operated radiographic equipment is not suitable for this purpose, new self-propelled testing equipment had to be designed which would function without any external energy source and would be able to crawl inside the pipes while being controlled from outside. These requirements led to the development of isotope crawlers for radiographic testing. A crawler is described that complies with the requirements. Details are given of the technical design of the crawler, which is a fourwheeled vehicle with a built-in motor and controls. It also describes how the testing apparatus with its incorporated ^{192}Ir gamma-ray source works, and gives details concerning the built-in or built-on electric battery equipment. The mode of operation of the crawler is explained together with its external control system, which is actuated by a pilot emitter. A description of the continuous monitoring facilities is also given. The results obtained with the crawler in various countries are compared. Finally, a comparison with other testing methods is presented. (auth)

31964 (IEA-334) GAMMAGRAPHY TECHNIQUES APPLIED TO THE QUALITY CONTROL OF WELDS IN THE PIPES OF WATER SYSTEMS. Sanchez, W.; Oki, H. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Apr 1974. 14p. (In Portuguese). Dep. NTIS (U. S. Sales Only) $4.00.

In the quality control of longitudinal or transverse welds in water pipe lines, two techniques were used, i.e., double wall and panoramic exposition. Three different water pipe lines systems were analyzed for weld defects giving a total of 16,000 gamma radiographs. The tests were made according to the criteria established by the ASME standards. The principal metallic discontinuities found in the weld were: porosity (32%); lack of penetration (29%); lack of fusion (20%); and slag inclusion (19%). The percentage of gamma radiographs showing welds without deflects was 39%. On the other hand 53% showed the presence of acceptable discontinuities and 8% were rejected according to the ASME standards. (auth)

31965 QUALITY STANDARD FOR STEEL CASTINGS FOR VALVES, FLANGES, AND FITTINGS AND OTHER PIPING COMPONENTS (DRY POWDER MAGNETIC PARTICLE INSPECTION METHOD). MSS Standard Practice SP-53. Arlington, VA; Manufacturers Standardization Society (1971). 5p. (ICONS-00196). $1.50.

This standard practice covers the application of Reference Photographs for Magnetic Particle Indications on Ferrous Castings, ASTM E-125 to the inspection and acceptance of steel castings for valves, fittings, flanges, and other pressure piping components made to applicable ASTM specifications. The use of this standard practice is contemplated to apply primarily for the purpose of safety code requirements for general oil refinery use under conditions of pressure and temperature stipulated in Section 3,

Refinery Piping Systems of ANSI B-31.3. Code for Pressure Piping. All castings shall be examined on all accessible as cast surfaces by magnetic particle procedures. The ASTM Standard E-109, Method for Dry Powder Magnetic Particle Inspection, shall be the criterion used for acceptance. Machined areas are not required to be re-examined. (auth)

31966 NONDESTRUCTIVE TESTING PERSONNEL QUALIFICATION AND CERTIFICATION. Recommended Practice No. SNT-TC-1A (Third Edition). Supplement A, Radiographic Testing Method. Chicago; American Society for Nondestructive Testing (1971). 44p. (ICONS-01818(Suppl. A)).

A training course and examination for qualifying and certifying personnel engaged in radiographic testing are presented. (TFD)

31967 NONDESTRUCTIVE TESTING PERSONNEL QUALIFICATION AND CERTIFICATION. Recommended Practice No. SNT-TC-1A (1968 Edition). Supplement E, Eddy Current Testing Method. Chicago; American Society for Nondestructive Testing (1968). 52p. (ICONS-01818(Suppl.E)).

A training course and examination for qualifying and certifying personnel engaged in eddy current testing are presented. (TFD)

31968 QUALITY STANDARD FOR STEEL CASTINGS: RADIOGRAPHIC INSPECTION METHOD FOR VALVES, FLANGES, FITTINGS, AND OTHER PIPING COMPONENTS. MSS Standard Practice SP-54. Arlington, VA: Manufacturers Standardization Society (1971). 3p. (ICONS-00197). $1.00.

This guide is intended to supplement ASTM E-71-64, ASTM E-186-67, and ASTM E-280-68, and deals with modifications and additions to these standards when applied to cast steel valves, flanges and fittings. The purpose of this guide is to provide a standard practice which will limit the number of possible variables in procedure and so simplify the negotiation between manufacturer and purchaser. There is no intent to imply that procedures outside of this guide are not satisfactory. This inspection guide is intended for use only when specified in the inquiry, contact or order and when mutually agreed upon by the manufacturer and the purchaser. It is difficult to rigidly interpret radiographs to a set of acceptance standards; consequently, there is a need for close cooperation between the manufacturer and the purchaser in applying radiographic acceptance standards. (TFD)

31969 NONDESTRUCTIVE TESTING PERSONNEL QUALIFICATION AND CERTIFICATION. Recommended Practice No. SNT-TC-1A (1968 Edition). Supplement D, Liquid Penetrant Testing Method. Chicago; American Society for Nondestructive Testing (1968). 69p. (ICONS-01818(Suppl.D)).

A training course and examination for qualifying and certifying personnel engaged in liquid penetrant testing are presented. (TFD)

31970 NONDESTRUCTIVE TESTING PERSONNEL QUALIFICATION AND CERTIFICATION. Recommended Practice No. SNT-TC-1A (Third Edition). Supplement B, Magnetic Particle Method. Chicago; American Society for Nondestructive Testing (1971). 78p. (ICONS-01818(Suppl.B)).

A training course and examination for qualifying and certifying personnel engaged in magnetic particle testing are presented. (TFD)

31971 NONDESTRUCTIVE TESTING PERSONNEL QUALIFICATION AND CERTIFICATION. Recommended Practice No. SNT-TC-1A (Third Edition). Supplement C, Ultrasonic Testing Method. Chicago; American Society for Nondestructive Testing (1971). 39p. (ICONS-01818(Suppl.C)).

A training course and examination for qualifying and certifying personnel engaged in ultrasonic testing are presented. (TFD)

31972 ACOUSTIC EMISSION MEASUREMENTS ON REACTOR PRESSURE VESSEL STEEL. Palmer, I. G. Mater. Sci. Eng.; 11: No. 4, 227-236(Apr 1973).

Results of acoustic emission measurements during deformation of flat specimens of reactor pressure vessel steel are presented. The output from a piezoelectric transducer taped to the specimen was amplified, filtered, and all peaks were counted. The total number of counts was recorded as a function of time in static tests at room and at low temperature as well as in fatigue tests. Effects of yielding, strain rate, notch sharpness, prestrain, and annealing were investigated. (Appl. Mech. Rev.)

31973 NONDESTRUCTIVE TESTING. Washington, DC; National Aeronautics and Space Administration (1973). 288p. $3.35.

A survey of current nondestructive test techniques (NDT) which have found use in industrial applications is presented. The following nondestructive test methods are discussed: liquid penetrants, ultrasonics, radiography, eddy-currents, thermal and infrared testing, microwaves, magnetic testing, leak testing, and strain sensing. Fundamental principles have been stressed in the discussion of each of these topics, followed by sections describing the contributions of NASA and its contractors relevant to NDT development. Each section is concluded by a useful reference list. A final chapter discusses several developing NDT techniques which should receive attention for industrial use in the near future. While the book stresses the relevance of NDT test methods applied to aerospace technology, the inclusion of basic NDT principles allows the reader to examine applicability of the techniques for varied industrial and commercial applications. A useful comparative guide of various NDT test methods is included and provides a ready means of selecting appropriate test techniques. This survey of NDT methods appears timely and should prove useful to engineers requiring a knowledge of accepted NDT methods and their application. (Appl. Mech. Rev.)

31974 QUALITY STANDARD FOR STEEL CASTINGS FOR VALVES, FLANGES, AND FITTINGS AND OTHER PIPING COMPONENTS (VISUAL METHOD). MSS Standard Practice SP-55. Arlington, VA; Manufacturers Standardization Society (1971). 16p. (ICONS-00198). $4.00.

This guide is intended to supplement the requirements of ASTM Specifications A216-70, A217-70, A351-69 and A352-68a and to provide a series of reference photographs typical of the various surface irregularities common to steel pressure castings and illustrations of generally acceptable and generally rejectable quality. The guide is to be the basis for a warrant of the surface quality to be expected for steel casting products meeting requirements under the American National Standard ANSI B16.5 covering Steel Pipe Flanges and Flanged Fittings. For additional quality standards defining premium quality steel castings, this guide may be supplemented by MSS Standard Practices SP-53, Quality Standard for Steel Castings for Valves, Flanges and Fittings, Dry Powder Magnetic Particle Inspection Method, and SP-54, Radiographic Inspection Guide for Steel Castings for Flanges, Fittings and Valves. The Standard Practices SP-53 and SP-54 are intended primarily to define premium qualities of steel castings while it is the purpose of this MSS Standard Practice SP-55 to provide a standard of acceptability for visual inspection of surfaces on steel castings. (auth)

Nuclear Explosions

31975 (AD-769578) HIGH-FREQUENCY SPECTRA OF EARTHQUAKES AND EXPLOSIONS. Final Report, 1 June 1972–31 May 1973. Tanis, E. J. (Environmental Research Inst. of Michigan, Ann Arbor (USA)). Sep 1973. 49p. (ERIM-192700-3-F; AFOSR-TR-73-1986). NTIS $3.00.

Existing seismic earthquake and explosion data have been analyzed as part of the near-field earthquake program. Source characteristics of small magnitude events were investigated to better understand earthquake/explosion discrimination techniques. Coda spectral analysis was found useful in determining source parameters from high-frequency data. Because of the large influence of path effect on spectral shape, the use of body wave data was found to present greater difficulties. Source parameters did not seem to be significantly different for explosions and earthquakes. Site location generally had a strong effect on source characteristics. (auth)

31976 (AD-774192) SEISMIC DECOUPLING EXPERIMENT: A COMPARISON OF SEISMIC MEASUREMENTS TAKEN IN THE DIAMOND DUST, DIAMOND MINE, AND MINE DUST HE SERIES OF EVENTS. Annual Report. Adams, J. W.; McLaughlin, R. H. (Environmental Research Inst. of Michigan, Ann Arbor (USA)). Feb 1973. 100p. (ERIM-197200-1T; AFOSR-TR-740143). NTIS $4.00.

The MINE DUST HE shot of May 10, 1972 was recorded at a number of seismograph stations operated by the University of Michigan, the U. S. Geological Survey, and by the NOAA Special Projects Group. The recordings obtained at the close-in University of Michigan stations disclosed that this shot was a factor of 1.30 larger than the previous HE shot of this series, based on particle velocity measurements. The geometric means of an energy ratio measure indicated that MINE DUST HE was 1.23 times larger than DIAMOND MINE HE; that DIAMOND DUST was 5.67 times larger than MINE DUST HE: that DIAMOND MINE was 6.32 times larger than DIAMOND DUST. (auth)

31977 (AD-777141) SOME AIDS FOR ESTIMATING DAMAGE PROBABILITIES IN ATTACKS AGAINST TARGETS WITH P AND Q VULNERABILITY NUMBERS: SUPPLEMENTARY TABLES FOR POINT TARGETS. Kephart, D. C. (Rand Corp., Santa Monica, Calif. (USA)). Nov 1973. 60p. (R-1168/1-PR). NTIS $3.75.

This is a supplementary volume to Rand Report R-1168-PR, which presents tables of damage probability as a function of nu-

clear bomb yield and delivery CEP for 50 selected P vulnerability numbers (PVNS) associated with hardened military targets. The supplement was prepared in response to requests by air force officers and agencies for additional damage probability tables estimating outcomes of attacks on certain overpressure-sensitive P-type and dynamic-pressure-sensitive Q-type point targets not listed in R-1168-PR. The additional probability of damage (PD) tables presented cover 56 PVNS and 52 OVNS of current military interest. The tables should be useful to air force planners and analysts in providing a quick-access source for data not otherwise readily available. (GRA)

31978 (AD-777841) COMPUTER CODE FOR HIGH ALTITUDE EMP. Chapman, T. C. (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio (USA). School of Engineering). Jan 1974. 82p. (GNE/PH-74-1). NTIS $7.25.

Thesis.

A relatively inexpensive computer code was developed to calculate the peak value of the electric field contained in an electromagnetic pulse generated by the gamma rays from a high altitude nuclear burst. The code is based on the Karzas and Latter theory for the production of Compton electrons and their interaction with the earth's magnetic field. The code can be used to calculate the peak value of the electric field at a target anywhere on or above ground level, resulting from a nuclear burst above 60 km altitude with a gamma yield up to 60 tons. Either the direct or the ground reflected wave can be calculated. With special care, bursts up to one kt of gamma yield can be used. (auth)

31979 (AD-777846) THEORY OF THE HIGH ALTITUDE ELECTROMAGNETIC PULSE. Lillis, J. R. (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio (USA). School of Engineering). Mar 1974. 118p. (GNE/PH-74-7). NTIS $9.00.

An approach to the electromagnetic pulse (EMP) caused by a high-altitude nuclear weapon burst is discussed. This approach involves the detailed calculations for the time-dependent electromagnetic fields of a single relativistic, Compton electron created in the upper atmosphere by the gamma radiation from the weapon detonation. The effect of all such electrons created is superimposed to obtain the net effect or the EMP measured by an observer. The basic theory developed ignores the conductivity which builds up in the surrounding air. This is shown to be a relatively good assumption for weapons with gamma radiation yields less than 1 kt. (auth)

31980 (AD-778164) GROUND SHOCK CALCULATION PARAMETER STUDY. Report 3. Influence of Type of Constitutive Model on Ground Motion Calculations. Baladi, G. Y.; Nelson, I. (Army Engineer Waterways Experiment Station, Vicksburg, Miss. (USA)). Apr 1974. 160p. (AEWES-TR-S-74-4-3). NTIS $5.00.

The report is the third in a series, "Ground Shock Calculation Parameter Study", centered on the Prairie Flat Event. The first report describes the effect of different elastic-ideally plastic constitutive model formulations on calculated ground shock, while the second report describes the effect of different bottom boundary conditions. This report documents the results of a parameter study conducted to determine the effects of using different types of nonlinear constitutive models to fit a given set of soil property data in calculations of high-explosive, airblast-induced, superseismic ground shock. (auth)

31981 (AD-894473) EMP GENERATED WAVEFORMS SUBSYSTEMS AND CIRCUITS. (Martin Marietta Corp., Orlando, Fla. (USA)). May 1972. Contract DAAH01-71-C-1366. 79p. (OR-11930). NTIS $7.00.

The primary objective was to develop a technique for predicting the characteristics of coupled energy on system cables having a wide range of parameters. It was also desired to present the results of the prediction technique in the form of nomographs or charts to be used by system designers. Energy coupled into complex systems generally contains many frequency components and amplitude variations. In order to facilitate design and test specification requirements, a simplified mathematical model of the major frequency and amplitude components was desirable. (auth)

31982 (FOA-C-4567-T3) RISKS FOR PRODUCTION OF NUCLEAR EXPLOSIVES IN SECRET. Gylden, N.; Holm, L. W. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Mar 1974. 29p. (In Swedish). Dep. NTIS (US Sales Only) $4.50.

The possibilities for criminals and illegal organizations to produce nuclear explosives are discussed. Based on the technical function of the nuclear explosive, the problems that must be solved in order to produce a bomb are described. The assumptions for obtaining the fissile material are treated. (SW)

31983 (NVO-1163-TM-37) TIME DEPENDENT SPECTRAL ANALYSIS OF GROUND MOTION. Hays, W. W.; Bennett, T. J.; Brumley, M. D. (Environmental Research Corp., Las Vegas, Nev. (USA)). Mar 1973. Contract AT(29-1)-1163. 48p. Dep. NTIS $3.00.

Analog computer signal analysis techniques have been developed to extract time dependent information from a seismogram. A three-element filter system consisting of a narrow band-pass filter, an absolute value operator and a low-pass filter transforms a nuclear detonation or earthquake ground motion time history into a set of response time histories and response envelopes. Each response time history and envelope displays the time dependence of amplitude changes in a seismogram for a discrete range of frequencies and has a physical correspondence to the response of a single-degree-of-freedom, viscously damped, harmonic oscillator. The diagnostic information obtained from application of these signal analysis tools to seismograms recorded at Beatty, Nevada, for underground nuclear explosions at the Nevada Test Site demonstrates their usefulness for studying surface wave propagation, frequency dependent site amplification, and duration of ground motion. (auth)

31984 (UCID-16566) ANALYSES OF ATMOSPHERIC PRESSURE RESPONSE DATA IN HOLE U9ITSeU-29 No. 2: NEVADA TEST SITE. Rozsa, R. B.; Snoeberger, D. F.; Baker, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Jul 1974. Contract W-7405-eng-48. 17p. Dep. NTIS $4.00.

An attempt was made to evaluate the permeability at a deep hole (U9ITSeU-29#2: Nevada Test Site) open full length underground by using low-cost, atmospheric-pressure-response measurements. Vertical flow between the hole wall (below the sealed surface casing) and the surface dominates lateral radial flow to a second hole (U9ITSU-29, 41 m distant, and open to the atmosphere). A definitive value of permissivity (permeability/porosity) was not obtained. Packers or other means of restricting vertical flow appear to be necessary for permeability testing of horizontal strata at these holes. (auth)

31985 EFFECTS OF EXPERIMENTAL NUCLEAR EXPLOSIONS ON SUBSURFACE SOIL. Il'in, V. P.; Trofimov, V. D. (Mineral Inst., Leningrad). Izv. Vyssh. Ucheb. Zaved., Geol. Razved.; No. 4, 74-78(Apr 1974). (In Russian).

Analysis of the results of underground nuclear explosions showed that the soil, as an elastic-plastic medium, readily yields to an explosive force. About half the energy of the explosion goes into the mass of the soil creating a cavity. Thickening of the soil around the cavity is not observed since radial cracks begin directly from its walls. The characteristics of the explosion depend primarily on the depth of the charge and to a lesser degree on its force. The formation of a cracked zone in rocky soil indicates the efficiency of using the energy of an explosion for crushing massifs and therefore suggests further development of an underground leaching method based on this. (MG)

Protective Structures and Equipment

31986 (AED-CONF-72-616-005, pp 171-176) PRESSURE SHOCK TEST OF SHELTER DOORS. Weigel, G. 1972. (In German).

From meeting of the Schutzkommission beim Bundesministerium des Innern; Greiburg, F. R. Germany (12 May 1972).

9 figs. Available from ZAED.

In Schutzkommission of the Federal Ministry of the Interior.

The results of investigations on the pressure resistance of commercially available pressure doors for large shelters are presented. The doors were tested under peak pressures of 3 atm. (GE)

31987 (RDT-E-9-1T(8-74)) HEPA FILTERS (AACC CS-1 WITH ADDITIONAL REQUIREMENTS). (USAEC Division of Reactor Research and Development, Washington, D. C.). Aug 1974. 14p. RSO.

High efficiency particulate air (HEPA) filters furnished to this standard shall be produced in accordance with requirements of AACC CS-1 with additional requirements. This standard includes requirements of AACC CS-1 with additional requirements and supplements. Sections of AACC CS-1 not specifically mentioned in this standard remain as written in the AACC standard. Additional requirements which modify or supplement the requirements of AACC CS-1 are arranged under the same paragraph numbers and headings as used in that standard. Additional requirements not included in AACC CS-1 are included. (TFD)

31988 ETO DOLZHEN ZNAT' I UMET' KAZHDYI. (Everybody Should Know and Understand This). Rimanova, Zh. I. Moscow; Ordena Trudovogo Krasnogo Znameni Voennoe Izdatel'stvo Ministerstva Oborony SSSR (1974). 48p.

This small brochure explains what the ordinary citizen needs to know about atomic blasts, i.e., the shock wave, thermal radiation, penetrating radiation, and radioactive contamination. The con-

struction of various types of hasty fallout shelters and dugout shelters is described in simple nontechnical language. A bicycle-driven forced-air circulation system is described. Various types of protective gas masks, respirators and simple face masks are shown pictorially. The use of protective clothing is demonstrated. A first aid kit is described for use against poison gases, harmful bacteria, and radioactivity. Measures are outlined for protecting the home, food supplies, and water from radioactive contamination. Emergency rescue measures and first aid procedures are illustrated. (SJR)

Safety Engineering

Refer also to abstracts 32344 and 32960.

Vacuum Engineering

31989 UNITIZED ULTRA-HIGH-VACUUM ROTATING INPUT LEADS. Blinov, I. G.; Boreiko, A. I.; Deulin, E. A.; Khrunichev, Yu. A. (Moscow Higher Technical School). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 1, 191-193(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 1, 168-170(1974).

The construction is described and the characteristics are presented of a series of standardized ultra-high-vacuum rotating input leads with a bellows vacuum seal. For comparison purposes the characteristics of foreign normalized input leads are presented. (auth)

ENVIRONMENTAL AND EARTH SCIENCES

31990 (CONF-730505-, pp 94-99) SYNERGISTIC EFFECTS OF TEMPERATURE AND OTHER ENVIRONMENTAL PARAMETERS ON ORGANISMS. Vernberg, F. J.; Vernberg, W. B. (Univ. of South Carolina, Columbia). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Organisms live in an environment that is a complex of many interacting parameters. Although two or more of these factors can vary simultaneously, most laboratory studies on aquatic organisms have varied only one environmental factor at a time in determining a functional response. This paper discusses the effects of two- and three-factor variations in both normal and man-made environmental conditions on various physiological response indexes. Since the biological success of an organism is determined by the ability of all life-cycle stages to survive environmental perturbations, examples of synergistic effects on various stages of organisms are described. (auth)

31991 (PB-229827) AWARDS REGISTER GRANTS ASSISTANCE PROGRAMS SHOWING PROJECTS AWARDED IN FISCAL YEAR 1973. (Environmental Protection Agency, Washington, D. C. (USA)). 1 Feb 1974. 503p. (EPA-220/1-73-004). NTIS $10.00.

A listing is presented of EPA's grants for the fiscal year 1973 including applicants, dates and amounts of awards, grant numbers, research problems, locations, titles, and project directors. (GRA)

31992 (PB-230085) ANNUAL REPORT, 1972. (National Environmental Research Center, Research Triangle Park, N. C. (USA)). Jun 1973. 84p. NTIS $7.25.

The history, organization, accomplishments, current endeavors and general goals of the National Environmental Research Center/Research Triangle Park, North Carolina are discussed. The individual Laboratories are described with details on the overall mission and organization of each. A summary, highlights of major accomplishments and future research emphasis are pointed out for each laboratory. (GRA)

31993 (PB-230377) QUARTERLY AWARDS LISTING, (1st) GRANTS ASSISTANCE PROGRAMS OF ENVIRONMENTAL PROTECTION AGENCY OF FISCAL YEAR 1974. Report for July-31 December 1973. (Environmental Protection Agency, Washington, D. C. (USA)). 1 Mar 1974. 73p. NTIS $6.75.

All the grants awarded by the United States Environmental Protection Agency in the first quarter of fiscal year 1974 are listed. The format of the publication is to have the initial sort by states then by the various grant programs having awards to grantees in the state. Each entry consists of the identification of the grantee, the program area for the project, grant title, grant number, award date, and dollar amount. (GRA)

Minerals and Ores

31994 (AEC-tr-7577) FLUID INCLUSIONS IN THE ORES OF INTRAGRANITIC URANIUM DEPOSITS OF LIMOUSIN AND FOREZ (MASSIF CENTRAL, FRANCE). Poty, B.; Leroy, J.; Cuney, M. (International Atomic Energy Agency, Vienna (Austria)). 1974. Translation of SM-183/17. 15p. Dep. NTIS $4.00.

Intragranitic deposits of uranium from Limousin and Forez, France were investigated to determine the physicochemical characteristics of fluid inclusions in the deposits. The three techniques used were: crushing of mineral particles in anhydrous glycerine for microscopic detection of the presence in inclusions of gas under pressure such as CO_2 and/or light hydrocarbons; microthermy or microscopic studies of phase changes in fluid inclusions; and gas phase chromatography of gases extracted from the inclusions. The results showed that pitchblende is initially deposited from a solution having a high concentration of CO_2, and that this deposition is caused by modification of the characteristics of the solvent, not by temperature modification. It was concluded that since uranium was transported by fluids with a high CO_2 concentration, detection of the CO_2 contained in the fluid inclusions by means of a crushing platen could be a simple supplementary method to be added to those generally used for uranium prospecting. (LCL)

31995 (CNEA-MP-5/108) EARTH SCIENCES: THEIR IMPORTANCE IN THE DEVELOPMENT OF NUCLEAR ENERGY IN SOUTH AMERICA. Stipanicic, P. N. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1973. 11p. (In Spanish). INIS.

From symposium on earth sciences in the development; Mexico City, Mexico (3 Jul 1973).

The present situation in the Latin American countries with respect to the current and future energy requirements and the resources available to them in liquid and solid fuels and hydroelectric potential is discussed. The importance of uranium reserves for these countries is emphasized. The costs of prospecting and exploration are estimated and it is shown how the geological sciences assist in the basic purpose of indicating areas in which the existence of U deposits can be expected. In South America there are numerous conditions which facilitate the possibilities of the existence of U deposits; these are the existence of extensive areas of acid magmatic rocks, the existence of special geological stages during which peneplanation had occurred; the existence of river basins in which sediments with special characteristics have been deposited; and the existence of special factors in the sediments favoring the concentration of U. (tr-INIS)

31996 (MLM-2111) GEOCHEMISTRY OF THE NATURALLY OCCURRING RADIOACTIVE SERIES. Kirby, H. W. (Mound Lab., Miamisburg, Ohio (USA)). 15 Aug 1974. Contract AT-33-1-GEN-53. 82p. Dep. NTIS $5.45.

This is one of a series of monographs intended, collectively, to provide the analytical chemist with an integrated source of information pertaining to the analytical chemistry of the naturally occurring radioactive series. A compendium of basic information and a guide to the literature of geochemistry as it applies to the natural radioelements is presented. The subjects covered are the origin, abundance, distribution and mineralogy of the natural radioelements and their use in nuclear geochronology. A glossary of petrological terms, a general bibliography of 35 titles for supplementary reading and a list of 152 cited references are included. The sole criteria for the selection and treatment of material have been those of interest and utility to the analytical chemist. Thus, geologists and geochemists should be aware that no information is included that is not already available to them from more comprehensive and authoritative sources. (auth)

31997 (STI/DOC-10/158) RECOMMENDED INSTRUMENTATION FOR URANIUM AND THORIUM EXPLORATION. (International Atomic Energy Agency, Vienna (Austria)). 1974. 93p. IAEA $5.00.

Following a general description of the uses, advantages, and limitations of radiation detection instruments used in prospecting for uranium and thorium deposits, minimum performance specifications are recommended for the following instruments or systems: portable Geiger-Müller counters; portable scintillation counters; airborne and carborne survey systems; portable and airborne gamma spectrometers; radon measurement instruments; G-M and scintillation well logging equipment; and ore-grade control systems. (LCL)

31998 URANIUM DEPOSITS IN UPPER LAZIO REGION. Locardi, E. (CNEN, Casaccia, Italy). Com. Naz. Energ. Nucl., Notiz.; 20: No. 7, 43-50(Jul 1974). (In Italian).

This paper describes the main research activities and the results obtained in connection with uranium prospecting carried out in the alkaline vulcanites of Upper Latium. The survey is already well in advance from the point of view of the knowledge of the ore deposits, well developed as regards prospecting, but very inadequate as far as mineral evaluation is concerned. However, it was found that the low uranium content is compensated by the wide extension, as well as by the favourable conditions of the deposit. The mineralizations in Latium are similar to that of the continental sandstone-type deposits found in intramountain basins, which supply the largest part of the US reserves. The mineralizations in Latium are, however, quite recent and the uranium reconcentration process is now under way; hence, both the mineral search and evaluation have to contend with particular problems that cannot be solved by comparison with other ore deposits. (auth)

31999 POSSIBILITIES OF URANIUM MINING FROM SEDIMENTS IN THE NORTH SEA. Schmidt-Mende, P. (Krupp (Friedr.) G.m.b.H., Essen (F.R. Germany). Forschungsinstitut). Meerestechnik; 5: No. 3, 81-85(Jun 1974). (In German).

2 figs.; 3 tabs.; 4 refs.

Uranium analyses of sediment samples in the area of the German North Sea coast showed uranium contents of between 0.2 and 1.5 mg U/kg. The highest contents were found in fine-grained sediments with a high proportion of organic substances. First tests followed for the enrichment of the uranium. The cost of the

uranium mining from these sediments are estimated at about 1,300 DM/kg U_3O_8. Economic mining will not be possible until sediments of far more than 100 mg U/kg are found or can be achieved by special methods. (auth)

32000 URANIUM-BEARING AREAS OF SUMADIA. Visic, S. (Inst. of Geology, Belgrade). Rad. Inst. Geol.-Rud. Istraz. Ispit. Nukl. Drugih Miner.; 7: 35-52(1971).

According to the investigation of the geophysical anomalies the main carriers of uranium in these areas are granites, volcanites and sediments, Tertiary in age. Most localities are located west of the central fault zone of Sumadia (Central Serbia). (Bull. Sci. Sect. A)

32001 SLIPPING THE PILL TO RADON DAUGHTERS. Thompkins, R. (Queen's Univ., Kingston, Ont.). Can. Mining J.; 95: No. 9, 84-87; 97(Sep 1974).

Radon gas is the parent of radon daughters which are the cause of the health problem of uranium miners. The sources of radon gas in uranium mines are described and why the rates of emanation are affected while breaking and transporting ore underground is explained. Information is included on: radon emanation from mine walls, clean and ore-littered stopes, mill tailings, and backfill material; mining methods which will reduce the radiation hazards in U mining; and mine ventilation requirements and costs. (LCL)

32002 REPORT ON THE SEMINAR ON URANIUM, OAK BROOK, ILLINOIS, MARCH 26-28, 1973. New York; Atomic Industrial Forum, Inc. (1973). 55p. (CONF-730367-). $5.75.

The Uranium Seminar 1973 was conducted to provide uranium producers and users with information about each other and to improve their working relationship. Thirteen papers were presented on U requirements and reserves, domestic U resources, forecasts of nuclear growth and U_3O_8 requirements, and economic aspects of U exploration, mining, and milling. Summaries of each paper and of questions and answer exchanges related to each paper are included. (LCL)

32003 PRECISION OF THE DETERMINATION OF THE POTASSIUM CONCENTRATION FROM CORE SAMPLES AND GAMMA LOGGING DIAGRAMS. Zykov, I. A.; Belyatskii, E. I. (Belorussian Scientific Research Geological Exploration Inst., Minsk). Dokl. Akad. Nauk USSR; 18: No. 7, 645-648(Jul 1974). (In Russian).

An evaluation was made of the precision of the geological and geophysical methods for the sampling of K salts. The discrepancies in the reserves of raw salts and oxides of K in three blocks of the Petrikov deposit does not exceed 5%. The mean relative squared error of the determination of the K concentration by core sampling (at 100% efficiency) is ±7.35%; among these errors are ±6.90% caused by the inhomogeneity of the K distribution and ±2.8% from the chemical analysis and sampling. The mean relative squared error of the γ logging is 10.2%; this is composed of ±0.5% from the inhomogeneity of the K distribution, ±3.6% from the reproducibility, and ±9.5% from the methodic error. The precision of the K determination from gamma logging can be increased by the use of large-dimension crystals and by the reduction of the time between the calibration of the apparatus and the logging studies. (tr-auth)

32004 URANIUM IN CRUDES OF THE LOWER VOLGA. Tverdova, R. A.; Fedina, V. V. (Scientific-Research and Design Inst. of Oil Industry, Volgograd, USSR). Geokhimiya; No. 7, 1045-1049(Jul 1974). (In Russian).

A luminescent-extraction method was used for the determination of uranium content in crude oils and crude oil components. Uranium concentration in crude oils is determined by their physical and chemical characteristics. The relation between uranium content and crude oil resinousness is more evident. The highest uranium content is concentrated in alcohol-benzene resins. The uranium content in oil components is practically constant, not depending on physical and chemical characteristics of oils. The main uranium content in oils is present in combination with nitrogen derivatives. The nature of the connection of uranium concentration with ash content and the ability of crude oil for uranium adsorption from stratal waters reveal the influence of secondary processes on uranium accumulation in resinous components. (auth)

32005 OPTIMIZATSIYA RESHENII PRI RAZRABOTKE URANOVYKH MESTOROZHDENII. (Optimizing Methods of Development of Uranium Deposits). Chesnokov, N. I.; Petrosov, A. A.; Vinogradov, A. A. Moscow; Atomizdat (1974). 296p.

Practical methods of handling initial data and mathematical programming which are currently finding wide use in planning, designing and carrying out scientific studies on uranium deposits are presented. In brief form, additional mathematical equations are presented for the practical use of these methods. Particular attention is devoted to the selection of a mathematical programming method for specific conditions. All sections of the book are accompanied by examples. 27 figs. 64 tables. 76 refs. (SJR)

32006 LOGGING TECHNIQUE FOR ASSAYING FOR URANIUM IN ROCK FORMATIONS. Givens, W. W. (to Mobil Oil Corp.). US Patent 3,828,189. 6 Aug 1974. Filed date 29 Nov 1972. 18p.

Disclosed is a uranium exploration technique for determining the uranium content of a formation traversed by a borehole. A delayed fission neutron assay log is obtained by irradiating the formation with repetitive bursts of fast neutrons and detecting delayed neutrons resulting from neutron fission of uranium at time intervals between the fast neutron bursts and after dissipation of the neutrons originating in the bursts. In addition, a response log is obtained by irradiating the formation with a source of fast neutrons whereby the neutrons from this source are moderated in the formation to lower energy levels and are subject to absorption. Secondary radiation attendant to these lower energy neutrons is recorded in order to obtain a log representative of the response of the formation to moderation and absorption of the neutrons. The two logs thus obtained are correlated in order to determine a corrected value of uranium content of the formation. (Official Gazette)

Radioactive Effluents

Refer also to abstracts 31692, 31712, 32035, 32045, 32049-32054, 32056, 32063, 32067-32069, 32096, 32102, 32129, 32190, 32195, 32196, 32446, 34301, 34316-34318, 34462, and 34470.

32007 (CONF-740346-1) DISTRIBUTION OF PLUTONIUM IN A ROCK CONTAINMENT ENVIRONMENT. Fried, S.; Friedman, A. M.; Weeber, R. (Argonne National Lab., Ill. (USA)). 26 Mar 1974. 15p. Dep. NTIS $4.00.

Studies were undertaken to determine the behavior of Pu in rock strata. The migration of solutions of Pu through cores of Niagara limestone and basalts was studied using ^{238}Pu as a tracer, and the surface absorption coefficient of Pu on the stones was measured. The results of these studies indicate that the basic assumption of the intercorrelation of the migration coefficients and surface absorption coefficients to the migration through fissures is verified, and that a great deal of effort must be spent studying the effects of other solute species, the chemical nature of the plutonium itself and the kinetics of the absorption process before any understanding of the macroscopic characteristics of the transport of plutonium can be reached. (LCL)

32008 (HASL-286, pp I.71-I.81) SEDIMENT SAMPLING NEAR MOUND LABORATORY, JULY 1974. Volchok, H. L.; Burke, J. C. 1 Oct 1974.

In fallout program.

Eight large diameter sediment cores and 16 water samples were taken from local water bodies in the vicinity of Mound Laboratory. These samples will be analyzed for Pu and other chemical and physical properties. The ultimate purpose of this program is to obtain information about the geochemical behavior of plutonium in a fresh water system. (auth)

32009 (KFK-1974) LITERATURE STUDY ON THE DIFFUSION MECHANISM OF RELEASED PLUTONIUM. Wilhelmi, M. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Actiniden). Jun 1974. 52p. (In German). INIS.

120 refs.; 7 figs.; 12 tabs. With abstract in German, English and French.

The application of pacemakers driven by plutonium batteries and development work on a blood pump call for prediction of the behavior and diffusion of the plutonium released, within the framework of the hazard consideration. Plutonium releases that have become known are evaluated and the essential results are described as far as the consequences were studied in more detail. Data are compiled on the behavior of plutonium on and in the soil and in water. Atmospheric contamination is only dealt with where it seemed necessary with a view to the objective pursued. Of the articles reviewed, the most important ones are mentioned and significant information is extracted and quoted in full as far as possible. (auth)

32010 (PB-229510) ENVIRONMENTAL RESEARCH IN 1973. Annual Report. (National Environmental Research Center, Cincinnati, Ohio (USA)). Feb 1974. 107p. (EPA-670/9-74-001). NTIS $4.50.

The research program of the national environmental research center in Cincinnati, Ohio, is directed toward solving major

environmental problems in wastewater management and treat ment, drinking water, solid wastes, toxicants from automobile exhaust and other sources, industrial and hazardous waste management and control, radioactivity emissions from nuclear power plants, and methods development and quality assurance. In this, the second annual report of the national environmental research center, the programs are described and progress during 1973 is delineated. Articles on various specific projects provide some detailed results of research progress. (GRA)

32011 (PB-231659) SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS. Number 10. (Environmental Protection Agency, Washington, D. C. (USA)). Jun 1973. 21p. NTIS $3.00.

Abstracts on the environmental aspects of air, noise, pesticides, radiation, solid waste and water are presented. A general category is also included. Countries represented include Spain, Sweden, the United States, Belgium, Canada, France, Great Britain, Italy, Japan, Netherlands, West Germany, New Zealand, Norway, and the USSR. (GRA)

32012 (PB-231660) SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS. Number 12. (Environmental Protection Agency, Washington, D. C. (USA)). Aug 1973. 22p. NTIS $3.00.

Abstracts on the environmental aspects of air, noise, pesticides, radiation, solid waste and water are presented. A general category is also presented. Countries represented include Belgium, Czechoslovakia, France, Great Britain, Sweden, Switzerland, Federal Republic of Germany, Japan, South Africa, Italy, Netherlands, New Zealand, and the United States. (GRA)

32013 (PB-231661) SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS. Number 13. (Environmental Protection Agency, Washington, D. C. (USA)). Sep 1973. 22p. NTIS $3.00.

Abstracts on the environmental aspects of air, noise, pesticides, radiation, solid waste and water are presented. A general category is also included. Countries represented include Finland, Federal Republic of Germany, Netherlands, France, Great Britain, Japan, Canada, and Belgium. (GRA)

32014 (PB-231662) SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS. Number 14. (Environmental Protection Agency, Washington, D. C. (USA)). Oct 1973. 22p. NTIS $3.00.

Abstracts on the environmental aspects of air, noise, pesticides, radiation, solid waste, and water are presented. A general category is included. Countries represented include Sweden, France, Federal Republic of Germany, Italy, Netherlands, Japan, Great Britain, Belgium, Canada, Switzerland, and the United States. (GRA)

32015 (PB-231663) SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS. Number 15. (Environmental Protection Agency, Washington, D. C. (USA)). Nov 1973. 22p. NTIS $3.00.

Abstracts on the environmental aspects of air, noise, pesticides, radiation, solid waste, and water are presented. A general category is included. Countries represented included the Federal Republic of Germany, Netherlands, Great Britain, Japan, Canada, France, Sweden, and Belgium. (GRA)

32016 (PB-231664) SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS. Number 16. (Environmental Protection Agency, Washington, D. C. (USA)). Dec 1973. 22p. NTIS $3.00.

Abstracts on the environmental aspects of noise, pesticides, radiation, solid waste, and water are presented. Countries represented include the Federal Republic of Germany, France, Canada, Belgium, Great Britain, and the Netherlands. (GRA)

32017 (PB-231665) SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS. Number 17. (Environmental Protection Agency, Washington, D. C. (USA)). Jan 1974. 22p. NTIS $3.00.

Abstracts on the environmental aspects of noise, radiation, solid waste and water are presented. Countries represented include the Federal Republic of Germany, Great Britain, the Netherlands, and France. (GRA)

32018 (WASH-1332(74)(Vol.1)) PROCEEDINGS OF THE SECOND AEC ENVIRONMENTAL PROTECTION CONFERENCE HELD AT ALBUQUERQUE, NEW MEXICO, APRIL 16–19, 1974. (USAEC Albuquerque Operations Office, N. Mex.; Sandia Labs., Albuquerque, N. Mex. (USA)). Jul 1974. 567p. (CONF-740406-(P1)). Dep. NTIS $13.00.

Separate abstracts were prepared for 15 of the 24 papers included. Abstracts of 9 papers appeared in NSA previously as numbers 29: 31455; 30: 2673, 3163, 9531, 12682, 15061, 15083, 15363, and 26779. (CH)

For abstracts of individual papers see: 31692–31694, 32019–32021, 32034, 32102, 32127, 32197, 32198, 32447, 34460, 34462, and 34470.

32019 (WASH-1332(74)(Vol.1), pp 45-62) SAVANNAH RIVER PLANT EFFLUENT REDUCTION PROGRAM. Peters, A. H. Jr. (E. I. du Pont de Nemours and Co., Aiken, SC). Apr 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

Approaches to the effluent reduction program at the Savannah River Plant and their effectiveness are discussed. Organizational structure, procedural control, and operations evaluation are key factors in the reduction of the release of radioactive wastes, nonradioactive wastes, and thermal effluents. (CH)

32020 (WASH-1332(74)(Vol.1), pp 77-88) ROCKY FLATS WATER RECYCLE PLANS. Plock, C. E. (Dow Chemical U.S.A., Golden, CO). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

The water usage and disposal program at the Rocky Flats plant is outlined. Topics discussed include: the various reasons why the Rocky Flats plant should recycle all of its aqueous wastes; the present water use and disposal system at Rocky Flats; and the proposed water use system and recycling plan for Rocky Flats. When the proposed construction is completed in 1976, the Rocky Flats plant will have complete containment. All of its aqueous wastes will be recycled, and the only losses will be due to evaporation. (auth)

32021 (WASH-1332(74)(Vol.1), pp 149-159) ARGON-41 REDUCTION AT THE AMES LABORATORY RESEARCH REACTOR. Voss, M. D. (Ames Lab., Iowa). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

Radioactive argon (^{41}Ar) in the gaseous effluent of the Ames Laboratory Research Reactor has been a subject of effluent monitoring since reactor operations were begun in 1965. While there has never been a time when the radiation protection standards were not met, there has been an added emphasis to the achievement of the lowest practicable release in recent years. Methods used to reduce ^{41}Ar release to the atmosphere are described. (CH)

32022 EMISSION OF RADIOACTIVE AEROSOLS FROM REPROCESSING PLANTS. Laser, M.; Beaujean, H.; Filss, P.; Merz, E.; Vygen, H. (Kernforschungsanlage, Juelich, Ger.). pp 99-107 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

The main radioactive components of the gaseous effluents of nuclear fuel reprocessing plants are ^{3}H, ^{85}Kr, $^{129+131}I$, and aerosols. Using only present technology, ^{85}Kr and ^{131}I will contribute significantly to the radiation burden in the neighborhood of a reprocessing plant, while the contribution of the aerosols is relatively small. In the future, the problem of the accumulation of long-lived isotopes should be considered. To reduce the aerosol emissions as well as the emission of gaseous and volatile isotopes, the specific off-gas streams must be treated separately, each in a special manner. Premature dilution by ventilating air should be prevented. An off-gas treatment system for HTR reprocessing plants is being developed along these lines. The fractional release of aerosols from the burner off-gas, the most important aerosol emitter of the HTR plant, is lower than 10^{-10} and 10^{-12} for cesium and the other non-volatile isotopes, respectively. (auth)

32023 MEASUREMENT AND ESTIMATION OF GAMMA DOSES RECEIVED AS A RESULT OF EMISSION OF ARGON-41 INTO THE ATMOSPHERE. Nagel, E. (Institut Federal de Recherches en Matiere de Reacteurs, Wuerenlingen, Switzerland). pp 273-277 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1973). (In French)

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

Measurements were made with various instruments of the ground-level gamma doses received in the area around a reactor emitting argon-41 at the rate of 5.5 mCi per second via a 70-m-high stack. The results were compared with the values obtained from calculations based on atmospheric diffusion studies performed in the Federal Republic of Germany. The same method was used to calculate maximum annual doses that could be received by persons living or working in the areas particularly exposed to the effects of continual emissions of argon-41 from the same reactor. The agreement between the measured values and the theoretical results is satisfactory, although the short duration of the comparison period should be borne in mind. (auth)

32024 CALCULATIONS OF DOSE AND POPULATION DOSE IN THE GENERAL ENVIRONMENT DUE TO BOILING-WATER NUCLEAR POWER REACTOR RADIONUCLIDE EMISSIONS IN THE USA IN 1971. Martin, J. A. Jr.; Nelson, C. B. (Environmental Protection Agency, Washington, DC). pp 319-335 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

Airborne emissions of radionucides during 1971 reported by operators of ten boiling-water nuclear power reactors in the United States of America were analyzed to calculate resulting doses in the general off-site environment. A recently developed computer program (AIREM) was used to perform the calculations. A sector-averaged diffusion equation, using facility-generated on-site annual average meteorology, was used to propagate the emissions from the release point out to 80 km. Up to 100 m of plume rise was included in the effective height of release. The AIREM code takes into account the finite extent of the cloud, decay by time of flight, first daughter product ingrowth and ground depositions and cloud depletion of particulates and halogens. (auth).

32025 METHODS FOR THE CALCULATION AND PREDICTION OF CONTAMINATION OF CLOSE-TO-GROUND AIR LAYERS BY STACK EMISSION OF NUCLEAR POWER PLANTS. Artemova, N. E. Arch. Energiewirt.; 28: No. 10, 503-512(May 1974). (In German).

3 figs.; 1 tab.; 10 refs. Also published in Russian in At. Ehnerg. v. 36(1), Jan 1974.

Two fast methods are described which are suitable for the practical calculation of air pollution, the Setton-Pasquill method introduced by the British Atomic Energy Commission and a Russian model to calculate the air pollution due to industry. The advantages and disadvantages of both methods are comparatively explained with experimental data. (GE)

Radioactivity Monitoring and Transport

Refer also to abstracts 31612, 31709, 31712, 32018, 32203, 32919, and 33896.

32026 (AD-777682) STUDY OF THE REGULARITIES IN THE WASHING OUT OF RADIOACTIVE FISSION PRODUCTION IN MOUNTAINS AND FOOTHILLS. Tsevelev, M. A.; Chalov, P. I.; Makhonko, K. P. Translated by C. T. Ostertag Jr. from Tr., Inst. Eksp. Meteorol.; No. 5, 102-115(1970). 23p. (FTD-HT-23-927-74). NTIS $3.00.

32027 (EGG-1183-1621) AIRBORNE SURVEYS OF TERRESTRIAL GAMMA RADIATION IN ENVIRONMENTAL RESEARCH. Burson, Z. G. (EG and G, Inc., Las Vegas, Nev. (USA)). 26 Nov 1973. Contract AT(29-1)-1183. 16p. Dep. NTIS $4.00.

Aerial surveys of terrestrial gamma radiation have many applications. These include (1) mineral exploration, (2) nuclear facilities environmental monitoring, (3) water equivalent of snow cover determinations, and (4) soil moisture estimates. The latter two applications are not yet operational in the United States, although snow surveys have been conducted in the USSR for many years. The primary detectors for all applications is the NaI(Tl) crystal. Single and multiple arrays are flown in a variety of aircraft (including helicopters) at altitudes varying from 25 to 150 m. Accuracy of results appear adequate for most applications. Accuracies can be improved by better accounting for the background components, particularly airborne radioactivity. (auth)

32028 (HASL-286) FALLOUT PROGRAM. Quarterly Summary Report, June 1, 1974-September 1, 1974. Hardy, E. P. Jr. (USAEC Health and Safety Lab., New York). 1 Oct 1974. 169p. Dep. NTIS $7.60.

Separate abstracts were prepared for 10 sections of this report. (CH)

For abstracts of individual sections see: 31533, 31534, 32008, 32029-32032, 32076, 32088, and 32101.

32029 (HASL-286, pp I.17-I.35) WORLDWIDE DEPOSITION OF ^{90}Sr THROUGH 1973. Volchok, H. L.; Toonkel, L. 1 Oct 1974.

In Fallout program.

The total ^{90}Sr fallout on the earth's surface in 1973 was 63 kilocuries. This is the lowest since the HASL program began in 1958. The seasonal and latitudinal variations have remained as before. Approximately double this amount of ^{90}Sr is anticipated to be deposited in 1974. (auth)

32030 (HASL-286, pp II.2-II.8) FALLOUT DEPOSITION AT WORLD LAND SITES. 1 Oct 1974.

In Fallout program.

Fallout ^{89}Sr and ^{90}Sr monitoring programs in the USA and at selected world land sites during 1974 are reviewed. Precipitation and dry fallout samples are collected over monthly periods at stations in the US and overseas, including Atlantic Ocean weather stations; samples of the lower atmosphere are collected by aircraft and high altitude balloons are used to collect samples at altitudes from 21 to 32 km; samples of milk, drinking water, and total diet are analyzed; and the ^{90}Sr content of human bone samples collected at various locations is measured. (CH)

32031 (HASL-286, pp III.2-III.24) ENVIRONMENTAL RADIOACTIVITY SURVEYS FOR NUCLEAR POWER PLANTS IN NORTH TAIWAN. Report for the Year 1973. Weng, P. S.; Chu, T. C.; Hsu, C. S.; Chang, H. T.; Pang, K. L. (National Tsing Hua Univ., Hsinchu, Taiwan). 1 Oct 1974.

In Fallout program.

Results are reported from environmental radioactivity monitoring for the nuclear power plants in North Taiwan which are under construction. During this monitoring period, the fifteenth nuclear weapon test was held at Lop Nor of mainland China on June 27, 1973 and caused significant increase in fallout radioactivity. Several thermoluminescent dosimeter monitoring stations have been established as compared with the previous years, and low volume air samplers were added to monitor airborne particulates, in addition to the use of gummed films and pots for sample collection. (auth)

32032 (HASL-286, pp III.25-III.66) ENVIRONMENTAL RADIOACTIVITY: ANNUAL REPORT, 1973, OF DEPARTMENT OF HEALTH, NEW ZEALAND. (National Radiation Lab., Christchurch, New Zealand). 1 Oct 1974.

In Fallout program.

During 1973 the country-wide average deposition of fallout ^{90}Sr on New Zealand was the lowest since measurements commenced in 1960. The concentration of ^{90}Sr and ^{137}Cs in milk reflected the changes in fallout deposition. The average levels during 1973 were the lowest since measurements commenced. (auth)

32033 (HASL-286(App.)) APPENDIX TO FALLOUT PROGRAM. Quarterly Summary Report, June 1, 1974-September 1, 1974. Hardy, E. P. Jr. (USAEC Health and Safety Lab., New York). 1 Oct 1974. 475p. Dep. NTIS $10.60.

Tabulated data are presented on fallout ^{89}Sr and ^{90}Sr deposited monthly at world land sites; the content of ^{90}Sr in milk and drinking water samples collected at various locations; and the content of Pb and selected fallout radionuclides in samples of surface air collected at various locations. Tables of fallout radionuclides and conversion factors are included. (CH)

32034 (WASH-1332(74)(Vol.1), pp 543-548) OVERVIEW OF THE AERIAL RADIOLOGICAL MEASUREMENT SYSTEM (ARMS) PROGRAM. Deal, L. J.; Doyle, J. F. (EG and G, Las Vegas, NV). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

The USAEC, Division of Operational Safety, funds the Aerial Radiological Measurement System Program to provide state-of-the-art aerial measurement capabilities to: respond to a major accident involving radiation sources anywhere in the Continental United States; perform radiation and other remote sensing surveys at major AEC facilities; and to conduct a large area terrain radiation mapping program around licensed facilities to form a basis for rapid assessment of a major radiation accident at such facilities. The capabilities of the program are described. (CH)

32035 (WASH-1332(74)(Vol.2)) PROCEEDINGS OF THE SECOND AEC ENVIRONMENTAL PROTECTION CONFERENCE HELD AT ALBUQUERQUE, NEW MEXICO, APRIL 16-19, 1974. (USAEC Albuquerque Operations Office, N. Mex.; Sandia Labs.,

Albuquerque, N. Mex. (USA)). Jul 1974. 590p. (CONF-740406-(P2)). Dep. NTIS $13.00.

Separate abstracts were prepared for 15 of 28 papers presented at the conference. The remaining 13 papers were previously abstracted for NSA and appeared as abstracts 30: 191, 333, 2830, 3161, 3212, 3711, 4058, 4068, 18380, 19448, 23147, 24809, and 27423. (MCG)

For abstracts of individual papers see: 31667, 31695, 31913, 32036–32038, 32047, 32078, 32128, 32129, 32199, 32956, 32957, 34312, and 34471.

32036 (WASH-1332(74)(Vol.2), pp 669-675) PANEL DISCUSSION ON ENVIRONMENTAL MONITORING AND REPORTING. Schoen, A. A. (Atomic Energy Commission, Washington, DC). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

Each of the major AEC sites has been doing environmental radiation monitoring essentially since the inception of their operations. In 1960, when some interest in environmental radioactivity began developing outside of AEC, the Commission decided that these reports should be made available to the public. There was no attempt at that time or before to establish specific requirements for uniform monitoring or reporting. Instead, it was intended that each contractor establish a monitoring program designed to assess the impact of each sites' operation on the environment to assure that the plant was operating as designed and intended without the undue release of radioactivity and to evaluate the environmental contamination and radiation levels in the context of the applicable NCRP and ICRP and the AEC standards and requirements. Since the environmental monitoring report has become increasingly important as a public document for reference by a widening variety of government and private interests the need for a more uniform monitoring and reporting program has become evident. The reporting requirements have also been expanded to cover nonradioactive pollutants for which there are applicable Federal, State, and local effluent standards. Proposed changes in reporting AEC environmental data are discussed. (CH)

32037 (WASH-1332(74)(Vol.2), pp 677-687) PANEL DISCUSSION ON ENVIRONMENTAL MONITORING AND REPORTING: THE HANFORD ENVIRONMENTAL SURVEILLANCE PROGRAM. Corley, J. P. (Battelle Northwest, Richland, WA). 17 Apr 1974. (BNWL-SA-5072).

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

The objectives of the Hanford environmental surveillance program are: to determine if operational control of waste releases is planned; to determine the efficiency of waste treatment and control; to determine compliance with environmental standards for the release of nonradioactive pollutants as well as radioactivity; to detect evidence of changes or trends in environmental measurements that may affect the health of personnel or the general population; to assess the radiation dose to the public or appropriate groups of the public that may be affected by plant operations; to determine levels of radioactivity in a variety of media on a continuing basis for evidence of previously unsuspected accumulations; to maintain a current evaluation of sources of radioactivity, such as fallout and natural radiation, for comparison with levels of radioactivity in the environment resulting from plant operations; and the maintenance of a data base and capabilities for handling major releases of radioactivity in the event such a release ever occurs. Information has been accumulated since 1945 and changes in emphasis and in data acquisition and processing systems are discussed. (CH)

32038 (WASH-1332(74)(Vol.2), pp 689-692) PANEL DISCUSSION ON ENVIRONMENTAL MONITORING AND REPORTING: SAVANNAH RIVER PLANT. McClearen, H. A. (E. I. du Pont de Nemours and Co., Aiken, SC). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

The Savannah River Plant has an environmental coordinator and each major operating facility has its own environmental committee which is made up of a cross section of the operating, service, and engineering personnel who work together. The responsibilities and areas of interest of these groups are enumerated. The environmental coordinator reports to the assistant technical director in Wilmington, Delaware. Data have been accumulated on the effects of the operation of a chemical separation plant, nuclear reactors, and a commercial fossil-fuel power plant on the radioactivity and chemical pollution of the environment. Since 1970 the monitoring program has been greatly expanded and improved standards have been developed for the management of stored and released radionuclides. Public information activities have been increased and reporting to the AEC has been improved and standardized. (CH)

32039 INVESTIGATION OF THE RADIOACTIVE FALLOUT IN BULGARIA FOR THE PERIOD 1964–1967. Teneva, M.; Manolov, L. Izv. Inst. Khidrol. Meterol., Bulg. Akad. Nauk.; 20: 163-181 (1972).

For a four-year period (1964–1967), at several stations located in different regions of this country and in different climatic zones, the artificial beta-activity of the deposited weekly and monthly fallouts was established. Some dependence of the activity of the fallouts on definite meteorological elements such as the quantity of precipitations and the direction and velocity of winds was searched. It was established that the activity of the weekly fallouts in Sofia is higher than that in the vicinity of the city, which is explained by the city's influence. The greatest total activity is deposited by western winds with mean velocities of 2–3 m/sec. As regards the annual activity of the monthly fallouts, it was highest in 1965, decreased in 1966 and is lowest in 1967. A clearly expressed spring maximum in the deposited activity is observed. The deposited activities at the stations in North Bulgaria are less than those in South Bulgaria. There is also a well expressed tendency of increased deposited activity at the high-mountain stations. A proportionality also exists between the activity from the monthly fallouts deposited on a given locality and the monthly sum of precipitations. (Abstr. Bulg. Sci. Lit., Math., Phys., Astron., Geophys., Geod.)

Atmosphere

Refer also to abstracts 32022–32025, 32128, 32196, 32207, and 32446.

32040 (COM-74-10908) GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE NO. 1. Summary Report, 1972. Miller, J. M. (National Oceanic and Atmospheric Administration, Boulder, Colo. (USA)). Jan 1974. 85p. (NOAA-74032910). NTIS $7.25.

The program designed to establish and maintain observation and analysis of data representative of the global background of selected gases and aerosols is described. The focus of the program is on establishing a long-term time series from ground-based instrumentation. Information is given on the baseline stations and the measurement programs relating to gases, aerosols, meteorology, solar-terrestrial radiation, and cooperative programs. The data acquisition system is described. Appendices contain the computer programs for lidar computations and MLO selected monthly measurements of Aitken particles by a Gardner counter 1971–1972. (GRA)

32041 (CONF-740106–(Absts.)) IAMAP/IAPSO COMBINED FIRST SPECIAL ASSEMBLIES, MELBOURNE, JANUARY 1974. Abstracts. Volume 1. (International Association of Meteorology and Atmospheric Physics, Toronto, Ontario (Canada); International Association for the Physical Sciences of the Ocean, San Diego, Calif. (USA)). 1974. 219p.

Abstracts are given of papers presented at the IAMAP/IAPSO combined first special assemblies. Topics include upper atmosphere pollution, radiation and climate, meteorology, clouds and surface biometeorology. (AT)

32042 (DP-MS-74-18) BIVANES AND FLYING TAILS. Pendergast, M. M.; Schubert, J. F. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1974. Contract AT(07-2)-1. 9p. (CONF-740922-10). Dep. NTIS $4.00.

From symposium on atmospheric diffusion and air pollution; Santa Barbara, California, USA (9 Sep 1974).

Early data from a 304-m-tall instrumented TV tower indicated long periods of non-zero vertical velocities in the southeastern United States. A need to include mesoscale circulations in transport and diffusion calculations and a desire to use bivane data to calculate cross-correlations (momentum and heat fluxes) in the atmospheric boundary layer (10 to 304 m) prompted a critical examination of errors associated with bivane measurement of vertical velocities. One of these errors is the aerodynamic "flying" of tails in horizontal flow. Wind tunnel tests on a variety of tails will be presented; these tests indicate that errors as large as five degrees in vertical wind direction can occur. Procedures for minimizing errors are discussed. (auth)

32043 (EUR-5105-d/f/i/n) RESULTS OF ENVIRONMENTAL RADIOACTIVITY MEASUREMENTS IN THE COMMUNITY COUNTRIES IN 1972: AIR–FALLOUT–WATER. (Commission

of the European Communities, Luxembourg. Directorate for Health and Safety). 1974. 79p. (In Several Languages). Dep. NTIS (US Sales Only) $7.00.

Results are presented of the measurements carried out in 1972 by the member States at the environmental radioactivity monitoring stations, together with certain data obtained at Euratom's Joint Research Centre, Ispra. An introductory note and three sections dealing with measurements of radioactivity in the air at ground level, in fallout and in water are included. Most of these measurements relate to total beta radioactivity. The measurement results for certain specific radionuclides are also given as well as the amount of precipitation observed at fallout sampling stations. Graphs are given to show the pattern followed throughout the year. A comparison is being drawn with the development over the years 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970 and 1971 as well as with the situation in 1972 in the United States and Canada. (auth)

32044 (NYO-3425-9) PROGRESS REPORT, 7 NOVEMBER 1973–31 MAY 1974. Reiter, R. (Frauenhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Garmisch-Partenkirchen (F. R. Germany). Inst. fuer Atmosphaerische Umweltforschung). 18 Jun 1974. Contract AT(11-1)-3425. 52p. Dep. NTIS $5.75.

Activities during November 1973 to June 1974 included measurement of cosmogenic radionuclides and fallout in the atmosphere at Zugspitze (2964 m a.s.l.), meteorological evaluation of radiosonde data from the eastern USA to eastern Europe, analysis of residence time of aerosols in lower stratosphere, and studies on the effects of solar flares on ^{7}Be and ^{32}P concentrations in the atmosphere. Tabulated and graphic data are presented of diurnal values of fallout, ^{7}Be, ^{32}P, ^{33}P, ^{35}S, and atmospheric precipitation for Nov. 73 through May 74. Progress in improving radiosonde equipment and tracking procedures and in improving lidar remote sensing to obtain complete information on aerosols in the atmosphere is discussed. (LCL)

32045 (STI/PUB-354) PHYSICAL BEHAVIOR OF RADIOACTIVE CONTAMINANTS IN THE ATMOSPHERE. Proceedings Series. Proceedings of a Symposium Held in Vienna, Austria, November 12–16, 1973. (International Atomic Energy Agency, Vienna (Austria)). Jul 1974. 540p. (In French and English). (CONF-731110-). IAEA $26.00

Separate abstracts were prepared for 31 of the 35 papers presented in these proceedings. The other four papers were previously abstracted and appear in NSA volume 29 as abstract numbers 00376, 00381, and 18335 and in volume 30 as abstract number 09563. (ERB)

For abstracts of individual papers see: 31709, 32022–32024, 32049–32070, 32104, 32600, 34193, 34317, and 34318.

32046 (UCRL-51627) ONE-DIMENSIONAL NUMERICAL MODEL OF PRECIPITATION SCAVENGING WITH APPLICATION TO RAINOUT OF RADIOACTIVE DEBRIS. Molenkamp, C. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Jul 1974. Contract W-7405-eng-48. 38p. Dep. NTIS $4.00.

A one-dimensional, time-dependent, entrainment model of cumulus convection has been modified to include a calculation of precipitation scavenging. The primary method of scavenging is postulated to be collection of suspended debris in cloud droplets during condensation nucleation and the subsequent inertial capture of these polluted droplets by falling raindrops. Other possible collection mechanisms are neglected, including inertial capture of debris particles by falling raindrops and attachment of debris to droplets or drops because of phoretic, diffusive, or electrical forces. Resuspension of debris because of evaporation of droplets and drops is modeled. Calculations are described for scavenging by a typical cumulus cell. Parameter studies are performed to examine the dependence of debris deposition on the initial height of debris in the atmosphere and on the fraction of debris passing through the condensation nucleation activation zone that serve as condensation nuclei. (auth)

32047 (WASH-1332(74)(Vol.2), pp 603-613) AUTOMATED COLLECTION, ANALYSIS, AND REPORTING OF ENVIRONMENTAL RADIATION EXPOSURE DATA. Voilleque, P. G.; Hill, D. G.; Tillitt, D. N. (Atomic Energy Commission, Idaho Falls, ID). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

An automated system was developed to acquire, process, and record very low environmental radiation exposure rates and meteorological data in the vicinity of an operating boiling water reactor. The installation and operation of the system have been undertaken as a demonstration project at the request of the AEC Directorate of Regulatory Operations (DRO). High sensitivity ion chambers designed by the AEC's Health and Safety Laboratory are used to permit measurement of a yearly direct radiation dose above background of less than 10 mrem to the whole-body, which corresponds to the as low as practicable design guide presently being considered for noble gas releases from light water power reactors. Every ten seconds the computer controlled system acquires exposure rate data from the ion chambers, wind speed and direction data from two levels (9.1 and 114.3 meters), and air temperature data from four elevations (1.5, 9.1, 45.7, and 136.6 meters) on the facility's meteorological tower. The analog data are converted to digital form and stored for manipulation. Data averages and standard deviations are computed and daily reports are automatically transmitted to remote data terminals. Reports of the hourly average data for the previous 24 hours, the daily average data for the previous 30 days, and the 5-minute average data on a continuous basis, can be obtained at the remote data terminals by interrogating the system. The availability of real time 5-minute averages is considered to be potentially very valuable for assessing the direct radiation dose in the event of an unplanned release of radioactivity. In addition to the routine daily printout and special reports which may be requested as needed, the system provides a permanent magnetic tape record of exposure rate and meteorological data. (auth)

32048 STUDIES ON DETERMINATION OF RADON AND ITS DAUGHTER PRODUCTS IN THE AIR USING TRIACETATECELLULOSE (TAC) FOILS. Domanski, T.; Chruscielewski, W.; Liniecki, J. (Inst. of Occupational Medicine, Lodz, Poland). pp 521-527 of Health Physics Problems of Internal Contamination. Budapest; Akademiai Kiado (1973).

From proceedings of the IRPA second European congress on radiation protection; Budapest, Hungary (3 May 1972).

The possibility of using triacetatecellulose foils for determination of radon and potential alpha energy of its decay products in mine air is theoretically considered from the viewpoint of radioactive equilibrium. Theoretical predictions were checked experimentally and found in basic agreement with each other. Effects of humidity, temperature, and dust coverage upon final track density were studied. Sensitivity and accuracy of the method appear satisfactory for purposes of practical monitoring in mines. (auth)

32049 DISPERSION OF AIRBORNE RADIOACTIVITY RELEASED FROM NUCLEAR INSTALLATIONS: POPULATION EXPOSURE IN LOCAL AND REGIONAL ENVIRONMENT. Vogt, K. J. (Kernforschungsanlage, Juelich, Ger.). pp 3-34 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

A survey is presented on the models representing the relation between radioactivity released into the atmosphere and contamination and population exposure in the local and regional environment of nuclear installations. The derivation of the fundamental diffusion equations is based on the K theory and the statistical theory of turbulent diffusion. The diffusion categories representing a measure for the dispersion capacity of the atmosphere and the standard deviations required for the application of the diffusion equations are discussed. Various systems specified in the literature are compared. The diffusion factors for short- and long-time emissions necessary to determine the environmental contamination and the population exposure from the source strength are derived from the basic diffusion equations for the various exposure pathways. The particular problems concerning dispersion in regional ranges are also considered. The environmental capacity approach is introduced as a general method of dealing with the environmental impact problems. With a view to facilitating practical application of the diffusion models, the results of parametric investigations are represented, with a survey on the most important computer programs for local environmental hazard analyses under normal and accident conditions as well as for regional studies. Two examples of application give some information on present and future emission rates of the relevant nuclides released from reactors and fuel reprocessing plants and on the resulting population exposure through the various pathways. (auth)

32050 ATMOSPHERIC DIFFUSION FROM AN OFF-SHORE SITE. Michael, P.; Raynor, G. S.;Brown, R. M. (Brookhaven National Lab., Upton, NY). pp 91-97 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency(1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

Analysis of the fate of airborne effluents from a nuclear reactor

at an off-shore site requires a better understanding of over-water atmospheric dispersion than currently exists. For this reason a diffusion study has been undertaken off the south shore of Long Island, New York, about 100 km from New York City. This study is using tracer material released from an anchored boat. Measurements of mean wind, turbulence, and temperature are made on portable towers on the beach, from an aircraft, and aboard the source boat. Plume geometry is documented by photography and from quantitative concentration measurements. Experiments under a variety of meteorological conditions indicate that over-water dispersion is very sensitive to meteorological conditions. From measured diffusion parameters it has been observed that over-water dispersion is significantly less than over-land, particularly when the on-shore flow is due to the sea breeze. This is because of the low aerodynamic roughness of the water and because low-level stable conditions are established since the water is at lower temperature than the air. Crosswind standard deviations of the plume a factor 2 less than the prediction of Pasquill category F have been observed at the shore with the source 6 km off shore. (auth)

32051 POSSIBLE ROLE OF RADIOACTIVE RELEASES FROM MULTIPLE NUCLEAR FACILITIES IN NUCLEATION PROCESSES IN THE ATMOSPHERE. Vohra, K. G. (Bhabha Atomic Research Centre, Bombay). pp 109-119 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

In studying the overall impact of radioactive releases from nuclear facilities on man's environment it is necessary to consider the role of ionizing radiations in some of the basic chemical processes in the atmosphere, particularly ion-induced chemical nucleation. This paper deals with experimental studies related to the possible formation of condensation nuclei in the atmosphere through a chemical reaction mechanism triggered by ionizing radiations. The role of ^{85}Kr and radon in producing condensation nuclei in the air is studied. It is shown that even a small dose of ionizing radiations in the air can lead to the formation of embryos nucleation in the presence of certain trace gases. These embryos can grow to larger nuclei. The results are discussed in relation to the possible implications of ionization doses in the air from reactor-stack releases on particle formation in the atmosphere. (auth)

32052 CONCENTRATION STATISTICS BASED ON EXPERIMENTAL DATA OF ATMOSPHERIC DIFFUSION. Gyllander, C.; Widemo, U. (AB Atomenergi, Studsvik, Sweden). pp 121-133 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

To determine the diffusion conditions of the lower atmosphere, the wind velocity and wind direction must be known, as well as a stability parameter λ, which includes the temperature gradient and the "free wind speed" above friction level. To compute the concentration, the generalized Gaussian plume formula was applied and the dispersion parameters σ_y and σ_z were deduced as continuous functions of meteorological data, easily obtained by measurements. The basic unit of concentration statistics is the hourly mean value. Starting from these data, in total 24000 hours of observations at the Studsvik Research Station, mean values covering even longer release periods are obtained for each 10° sector. The procedure implies that in the direction concerned each standard distance is charged with a contribution of concentration, computed from actual meteorological data. The concentration statistics are a set of universal basic programs intended for determining the air concentration in: (a) normal operation, an annual cycle; and (b) accident conditions, short-time releases. By using frequency statistics, concentration values which may be reached or exceeded with a given degree of probability are obtained for actual release data. The results have been related to data on atmospheric diffusion used in safety analyses by (among others) UKAEA and USAEC. (auth)

32053 EFFECT OF LENGTH OF EXPOSURE ON THE EVALUATION OF ATMOSPHERIC DIFFUSION COEFFICIENTS. Brun, J.; Hugon, J.; Le Quinio, R. (CEA, Paris). pp 135-151 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974). (In French)

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

Fragmentary results obtained in more general atmospheric diffusion experiments using a continuous source were used originally for evaluating the effect of sampling duration on the maximum concentrations of the effluent discharged. Since that time, data have been obtained in the course of a dozen or so systematic releases for sampling periods ranging from a quarter of an hour to four hours. The principal results are described and compared with those obtained taking fluctuations in wind direction into account. (auth)

32054 TRACER METHOD FOR COMPAIRING THE GROUND-LEVEL DISTIRUBTION OF AEROSOLS AND GASES EMITTED FROM NUCLEAR FACILITIES. Rzekiecki, R. (CEN de Cadarche, Saint-Paul-lez-Durance, France). pp 153-166 of Physical Behavior of Radioactive Contaminants in the atmosphere. Vienna; International Atomic Energy Agency (1974). (In French)

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

In order to assess the possibility of comparing the diffusion behavior in the atmosphere of an aerosol of diameter less than 10 μm with that of a gas, simultaneous emissions of the gas tracer SF_6 and the aerosol tracer uranine-S were made from various sites under various meteorological conditions. The diffusion coefficients were compared on the basis of the normalized concentrations measured in the same conditions at various distances from the emission point. In the cases studied, a difference in behavior is detectable only at wind speeds greater than 5 m/s. Within a factor of 2 it is possible to apply to the gaseous radioactive effluents the experimental graphs plotted on the basis of uranine-S aerosol, a tracer which has been used for ten years or more at French nuclear sites. (auth)

32055 VARIABILITY OF WASHOUT RATIO FOR SOME FALLOUT RADIONUCLIDES. de Bortoli, M.; Gaglione, P. (EURATOM, Ispra, Italy). pp 167-180 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

The air concentration of some fallout radionuclides and the activity deposited on the ground were measured at Ispra on a monthly basis. The values of the washout ratio, i.e. the ratio of the activity concentration in rainwater to that in air, derived from these data and from rainfall data, were analysed to look for possible influences by radionuclides and meteorological parameters. This study showed that the individual values are scattered over a wide range (a ratio of almost 60 exists between maximum and minimum) with an overall of 6.9×10^5 pCi/m^3 of rain per pCi/m^3 of air. The radionuclides do not contribute significantly to the variation, whereas the monthly effect is highly significant; however, no correlation is apparent between washout ratio and some meteorological parameters, such as rain and humidity. (auth)

32056 IMPROVEMENT OF A COMPOSITE DUST SAMPLER AND ITS UTILIZATION IN ENVIRONMENTAL RESEARCH. Kamada, H.; Yukawa, M.; Saiki, M. (National Inst. of Radiological Sciences, Chiba, Japan). pp 181-187 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

Various methods of sampling airborne dust were examined for improvement on the conventional collector. Radiological studies on the behavior of radionuclides in the environment were also carried out by use of this collector. For a low-level radioactivity survey on airborne dust, a filter-type sampler was unsuitable and a Cottrell-type sampler was inadequate to collect a large amount of dust. A composite dust sampler was therefore assembled, designed to collect and deposit up to 99% of particles, size 10 μm, at a flow rate of 10^3 per minute. It was indicated that the yield was more than twice as high as obtained by the conventional Cottrell method. Since 1965, the monthly variation of radionuclide concentration in air has been effectively observed using the improved sampler. Short-lived radionuclides due to a nuclear explosion test at the South Pacific Ocean were clearly detected in this survey, and the diffusion velocity was calculated as 3 to 4 m/s, using the data obtained in 1968. To estimate the time and degree of contamination by fission products to airborne dust, the daily change of the radioactivity ratio $^{95}Nb/^{95}Zr$, which is the degree of growth of ^{95}Nb and decay of ^{95}Zr in the dust samples, was carefully determined with a Ge(Li) detector from October 1971 to April 1972. Then fractionation of effects from multiple

nuclear tests and estimation of the time of the occurrence were successfully achieved by simultaneous equation analysis. A satisfactory result, in the authors' opinion, was obtained. (auth)

32057 EFFECT OF METEOROLOGICAL VARIABLES ON ATMOSPHERIC SUSPENDED PARTICULATES AND ASSOCIATED NATURAL RADON AND THORON DAUGHTERS. Reimer, A.; Reichert, J. K.; Scott, A. G. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). pp 189-210 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

A study of suspended particulates and associated natural radionuclides in the lower atmosphere was undertaken at the Whiteshell Nuclear Research Establishment not only because of the expectation that it would illuminate the sometimes perplexing behavior of airborne fission products, but also because the data are intrinsically important in monitoring atmospheric diffusion and air pollution. The results show that summer radon and thoron daughter concentrations depend mainly on temperature and wind, whereas no clear-cut association is found in winter. Monthly mean particulate concentrations varied from about 25 $\mu g/m^3$ in summer to about 8 $\mu g/m^3$ in winter except during soil erosion. Harmonic analysis revealed a particulate concentration cycle of 3 to 4 days, which agrees well with an atmospheric pressure periodicity for this latitude of 3.5 to 3.9 days. This similarity exemplifies the physical dependence of pollution cycles on synoptic-scale meteorological features. (auth)

32058 HELICOPTER-BORNE MEASUREMENT OF RADIATION EXPOSURE AT A BWR NUCLEAR POWER STATION. Brinck, W. L.; Averett, W. J.; Kolde, H. E.; Kahn, B. (Environmental Protection Agency, Cincinnati). pp 231-243 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

A helicopter was used to carry instruments for measuring the exposure rate from radioactive gases released at the stack of a boiling water reactor because of its maneuverability and its ability to fly at lower altitudes and more slowly than fixed-wing aircraft. A Shonka muscle-equivalent ionization chamber plus electrometer and continuous recorder was used to measure radiation exposure rates. The tests, performed over flat terrain near the sea coast, consisted of: measurements at ground level; comparison of measurements in the helicopter and on the ground; and horizontal traverses through the plume at varying elevations and distances from the stack. The measured radiation exposures were compared with values computed on the basis of the Pasquill-Gifford diffusion equation for radiation from a finite cloud. This initial test of the technique provided values of relative radiation exposure rates and the horizontal and vertical dimensions of the radiation field of the plume under the neutral atmospheric stability that existed during the measurements. Thirty-four km from the stack, the radiation plume could still be readily defined; the maximum net reading approximately equalled the naturally occurring background. The major need in using this monitoring technique will be to relate the "instantaneous" measurement of the plume from the helicopter to long-term exposures at ground level. The technique will be particularly useful if the observed plume dimensions can define atmospheric stability conditions. (auth)

32059 ESTIMATES OF DRY DEPOSITION AND PLUME DEPLETION OVER FORESTS AND GRASSLAND. Hosker, R. P. Jr. (National Oceanographic and Atmospheric Administration, Oak Ridge, TN). pp 291-309 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

A standard plume-diffusion model, corrected for dry deposition and consequent plume depletion, is applied to hypothetical sources located at several heights above homogeneous stretches of grassland and of forest. The plume is assumed to be composed of material for which gravitational settling is negligible; this should be typical of many effluents including possible accidental plutonium releases. Only daytime conditions are considered. Dispersion coefficients and deposition velocities are fairly well established for the open grassland case and are taken directly from the literature. For a forest, only estimates of these terms can be made. The present estimates attempt to account for the probable effects of the forest on the above-canopy turbulent diffusion and on the effluent deposition velocity, using the recent literature as a guide. Because of the uncertainties implicit in this approach, ranges of values for the necessary terms are utilized. Downwind distance variation of vegetation-level concentrations and plume depletion fractions are presented for several source heights over a range of possible stability categories and deposition velocities. The relative efficiency of a forest as a remover of effluent material is discussed, and a suggestion is considered that, in cases where concentrations are small enough to avoid biological damage to the trees, a forested region might serve as an effective filter for particulate and gaseous emissions. (auth)

32060 NUMERICAL MODEL FOR THE STUDY OF DISPERSION OF RADIOACTIVE POLLUTANTS IN AIR. Zuccaro-Labellarte, G. (CNEN, Rome). pp 311-318 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

A method is described for numerical solution of the diffusion equation for dispersion in air of radioactive pollutants from an elevated source. Instantaneous and continuous emissions are considered. In the case of instantaneous emission, the model calculates the pollutant concentration for any point as a function of time; in the case of continuous emission, the average yearly concentration for any point is calculated. Input data are: height and temperature of the released material, discharge rate, together with climatological frequency data relating to wind speed, wind direction, atmospheric stability and morphological features in the area examined. The model makes it possible to study the particular cases of maximum concentration and to determine, on the basis of the maximum permissible concentration in air, the maximum dischargeable amount of each radionuclide. The model was applied to evaluate the ground-level concentrations due to the potential emission of radioactive effluents from the reprocessing plant EUREX of the Comitato Nazionale per l'Energia Nucleare, Saluggia, Italy. In particular, the maximum dischargeable amounts of ^{239}Pu, ^{3}H, and ^{85}Kr were evaluated. The model is also provided with a multiple inversion subroutine to take into account the effect of the presence of an inversion layer on the ground-level concentration. The model was written in FORTRAN IV and tested on an IBM 360/44 computer. (auth)

32061 CHEMICAL PROPERTIES OF ^{210}Po IN THE ATMOSPHERE. Abe, S.; Abe, M. (National Inst. of Radiological Sciences, Chiba, Japan). pp 367-373 of Physical Behavior of Radioactivity Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

Naturally occurring ^{210}Po in airborne dust has been used as a tracer in various fields, such as health physics or meteorology. A knowledge of the chemical properties of radionuclides in the atmosphere is useful in understanding the behavior and fate of the nuclides dispersed in the atmospheric environment. Owing to difficulties of analysis, however, there is little information on the chemical properties of such nuclides. ^{210}Po exists in the entire atmosphere and its range of transport is worldwide; therefore, information on ^{210}Po in the atmosphere is useful for understanding the transfer mechanism of other nuclides. The volatility and solubility of ^{210}Po in airborne dust are reported. The volatile tendency of ^{210}Po in airborne dust as a function of temperature can be expressed in a two-stage curve. Natural ^{210}Po in airborne dust seems to contain at least two volatility groups of ^{210}Po compounds. The solubilities of ^{210}Po in airborne dust against all reagents are classified into three groups. From comparison of the result with known data, it is recognized that there are at least two ^{210}Po compounds in airborne dust. (auth)

32062 REGIONAL AND GLOBAL SCALE DISPERSION OF ^{85}Kr FOR POPULATION-DOSE CALCULATIONS. Machta, L.; Ferber, G. J.; Heffter, J. L. (National Oceanic and Atmospheric Administration, Silver Spring, MD). pp 411-426 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

A practical regional and global-scale dispersion scheme is presented which permits the calculation of ^{85}Kr dose to the world population from ground-level sources. The world-wide accumulated exposure is treated in several phases employing progressively broader meteorological concepts. For the first 6 hours

or about 100 km of travel, a local wind-rose is used to calculate the horizontal frequency distribution of the plume in sectors around the source. From 6 hours to about 3 days, horizontal plume dispersion is derived from a climatology of air trajectories. From 3 to 30 days mean low-level airflow is used to estimate the plume centerline. Horizontal dispersion about the centerline reflects both diffusion and plume meander. After about 30 days of travel in temperate latitudes, the trajectories return to their original longitude. Thereafter, it is assumed that zonal mixing is virtually complete; only north-south and vertical mixing and radioactive decay continue to affect ground-level concentrations. A two-dimensional mixing model in which the flux takes place in the direction of the gradient determines ^{85}Kr concentrations during this phase. The average horizontal diffusion coefficient in the troposphere is assumed to be 3×10^6 m^2/s. Vertical dispersion for all phases is based on coefficients of vertical diffusion averaging 5 m^2s. About two years following injection into the air, the ^{85}Kr surface air concentration becomes virtually uniform over the globe and subsequent decreases in concentration are caused almost entirely by radioactive decay. Calculated mean concentrations are multiplied by affected population to determine cumulative exposure during each phase. The composite model is applied to two sites in the United States of America; one in the midwest upwind of a large city and a second near the east coast remote from a major population center. It is concluded that detailed analysis of early plume history is necessary to correctly evaluate exposure to local and regional populations but is not essential for evaluation of long-term world population exposure. (auth)

32063 RECENT ANALYTICAL AND EXPERIMENTAL EFFORTS ON SINGLE-SOURCE EFFLUENT DISPERSION TO DISTANCES OF 100 km. Van der Hoven, I. (National Oceanic and Atmospheric Administration, Silver Spring, MD); Dickson, C. R.; Start, G. E.; Wendell, L. L. pp 427-441 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

An objective mesoscale streamline and trajectory computer analysis has been developed and applied using a network of observed winds. Hourly winds are analyzed by a random-to-grid interpolation scheme. By further interpolation between hourly grid point wind vectors, hypothetical particle trajectories are constructed. The technique is further developed to account for diffusion along the undulating trajectories by simulating a continuous source through serially released Gaussian puffs. A computer-produced graphic analysis is presented for periods of a day, a season, and a year. Field results of the diffusion of a tracer released over a three-hour period are shown for a distance of 100 km. Air trajectories during the period are determined as measured by floating tetroons and as computed by a windfield analysis. Current regulations in the United States of America for nuclear facility licensing require an assessment of radiological doses to distances of 50 miles. This is commonly done through use of a very simplified technique which does not permit a realistic appraisal of the impact from a release to the atmospheric environment. The newly developed trajectory-diffusion technique offers a more realistic alternative. (auth)

32064 PRINCIPLES FOR FULL NUMERICAL TREATMENT OF PHYSICAL TRANSFERS IN THE ATMOSPHERE AND HYDROSPHERE. Doury, A. (Centre d'Etudes de Monthery, France). pp 443-456 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

The behavior of contaminants in the atmosphere and hydrosphere is governed by a number of physical laws independent of the inherent stability of these contaminants (chemical stability, radioactivity) which must always be allowed for in the final balance. The principles described here for numerical treatment of physical transfers of this contamination should be regarded not as a new forecasting model, but as an attempt to develop a general methodology based on a synthesis of all the models and specialized data currently available. This paper is a deterministic approach, in which the four categories of phenomena or processes, namely advection, diffusion, the sources, and the wells, are clearly distinguished and the diffusion equation is solved by a Gaussian solution, for which the coefficients, which are variable, are drawn from experimental results. Since the effects of diffusion are always regarded essentially as a function of their duration, and since the smaller its range of spatial and temporal validity, the closer to physical reality is the solution given by the Gaussian, the elementary formulation adopted is that which corresponds to instantaneous point emission. This elementary formulation makes the resulting model very flexible, in particular making it possible with a reasonable minimum of calculation to resolve practically every kind of problem likely to occur both on a local and regional scale and over very large distances (point sources and extended sources, instantaneous and continuous sources, transient regimes, complex carrier currents, vertical stability conditions varying in time and space, depositions, washout and resuspensions). The method is, of course, infinitely perfectible since the numerical values of the parameters can be modified on the basis of experience. These numerical values are available already to a sufficient extent for the atmosphere but those for the oceans are inadequate and a world-wide effort is necessary to complement and refine them. (auth)

32065 AIR SURVEILLANCE ASPECT OF MOUND LABORATORY'S ENVIRONMENTAL CONTROL PROGRAM. Hebb, J. L. (Mound Lab., Miamisburg, OH). pp 457-464 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

Mound Laboratory has been in the "environmental protection business" since 1949, long before the concerns of today's environmental-sensitive society, and as a result has developed a comprehensive environmental control program. This broad program deals with all materials, both radioactive and explosive, handled or processed at the Laboratory which could be released either on or off site. The scope and effectiveness of the environmental control program demonstrates Monsanto Research Corporation's concern for the wellbeing of their employees and the communities surrounding the Laboratory. The program recognizes that a fully co-ordinated approach is the only way to effectively control contaminants released to the environment. This approach involves co-operation with pollution control authorities, close co-ordination of efforts within the Laboratory, willingness to apply technical expertise to the solution of problems and the expenditure of funds necessary to provide proper control systems. As a perfective portion of the environmental control program for Mound Laboratory, the air surveillance system was designed, with the objective of monitoring atmospheric conditions on and off site to validate the effectiveness of the environmental control program and to inventory airborne radioactivity orignating from Mound Laboratory. The conceptual scheme of the air surveillance system is based upon the closed system approach and determines where airborne radioactive materials tend to locate in the surrounding environment. (auth)

32066 ARTIFICIAL RADIOACTIVE MATERIAL AT HIGH ALTITUDES IN THE ATMOSPHERE. Stewart, K. (Atomic Weapons Research Establishment, Aldermaston, Eng.). pp 465-476 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

The radiological hazard to crew and passengers of aircraft flying in the lower stratosphere due to debris from past and possible future nuclear weapons test are estimated and compared with allowable levels. The significance of the radioactive contamination due to the burn-up of space auxiliary power generators is also considered. The present levels of radioactivity do not constitute a hazard but the material from an atmospheric test could produce significant levels for a few days after the event. (auth)

32067 DIFFUSION OF RADIOACTIVE GASEOUS EFFLUENTS ON A REGIONAL SCALE AND EVALUATION OF THE RISKS. Cagnetti, P. (CNEN, Rome); Pagliari, M. pp 477-486 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

In a previous study presented at the Third Congress of the International Radiological Protection Association, the authors analyzed the problem of diffusion of gaseous effluents on a regional scale with the aim of producing a reliable formula for calculating the concentrations in the atmosphere in analyses of the safety of nuclear facilities. After a short account of the results of this study, the radial symmetry diffusion equation is solved for the case where the initial conditions are characterized by a strong wind, and the result is compared with that ob-

tained in the above-mentioned study for the case of initial stability and a light wind. The two solutions are found to differ by a factor of 2 to 3, which would be further reduced if in the second case (initial stability) the concentrations could be expressed as a function of the distance attained instead of the path covered. And lastly, although this factor is negligible compared with the accuracy of the data on which the proposed formula is based, the authors describe a statistical study of the various trajectories which could occur in Europe, in order to facilitate the application of the formula and to assist research into the relation between scalar path and vectorial distance of a gaseous effluent. (auth)

32068 CLASSIFICATION OF WEATHER ACCORDING TO LAPSE RATE. Helm, W. R.; Winkler, B. C. (Atomic Energy Board, Pretoria). pp 487-494 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

To estimate the risks associated with nuclear installations it is necessary, amongst other matters, to quantify the dispersion of gaseous and airborne radioactive effluents originating from such installations. In this context it is common practice to utilize the well-known dispersion formulas in which the diffusion parameters are evaluated according to semiempirical methods introduced by Sutton and Pasquill. This procedure is not altogether satisfactory since it can be difficult in practice to correlate given weather conditions unambiguously with the defined weather categories. A study is described in which an attempt has been made to represent experimental diffusion data by use of the dispersion formula in which the diffusion parameters are correlated with the vertical temperature gradient. The apparent advantages of this approach are briefly discussed. (auth)

32069 PROBABILITY OF DOSE: A COMPUTATION OF INDIVIDUAL AND POPULATION DOSE IN AN URBAN AREA UNDER ACCIDENT CONDITIONS. Gyllander, C.; Widemo, U.; Bergstroem, S. O. W. (AB Atomenergi, Studsvik, Sweden). pp 495-504 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

Investigations at two Swedish stations produced methods of calculating atmospheric diffusion for high-level release during 1 hour. Starting from this basic unit, concentration statistics given in terms of relative concentration were computed for a number of release and sampling times longer than 1 hour. The demand for siting in densely populated areas required the development of a computation procedure to evaluate the potential risk in case of an accidental release. In such a case the risk analysis must take into consideration not only the dose but also the number of individuals that could get this dose and the different types of health effects which could result. This led to a modification of the frequency statistics so that the new version refers to numbers of individuals integrated within those isolines of dose that are relevant for each specific health effect considered. Briefly, the dose calculations include the following steps: relative concentration; population distribution; external whole-body dose from a cloud of finite dimensions; internal whole-body dose; thyroid dose; health effects. In this report the procedure is illustrated by a practical example whose aim is to determine the risk to individuals in the close-in zone as well as the total social risk with regard to the number of injuries to people in densely populated areas. The results represent consequences to be expected with a given degree of probability in the case of an accident. The consequence analysis is performed for a risk level of 5%, which is taken as the standard for concentration, dose and health effects. For comparison, the total range of associated values of the frequency statistics is given. (auth)

32070 PHYSICAL BEHAVIOR OF RADIOACTIVE CONTAMINANTS IN THE ATMOSPHERE AND CONSEQUENT ENVIRONMENTAL IMPACTS. Panel Discussion. pp 505-519 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

Several aspects of atmospheric diffusion and the transport of radioactive particulates and air pollutants in the atmosphere are discussed. (ERB)

32071 SAFETY BY MEANS OF NEW MONITORING INSTALLATIONS: RADIOACTIVITY IN THE AIR. Kosmowski, A.; Gebauer, H. Wasser, Luft Betr.; 17: No. 7, 205-208(Jul 1973). (In German).

The rapid development of technical and scientific application of isotopes and the fast increasing part of nuclear energy in electrical power supply necessitate radiation-biological research as well as continuous improvement of metering techniques. Recent development in the Federal Republic of Germany is discussed. New metering equipment for monitoring the radioactivity of waste gases originating from nuclear power plants is described. (Pollut. Abstr.)

32072 INVESTIGATIONS ON RADIOACTIVE AEROSOLS IN THE ATMOSPHERE AS WELL AS FALLOUT NEAR THE CITY OF WROCLAW. Glowiak, B.; Pacyna, J. (Politechnika Wroclawska (Poland)). Staub-Reinhalt. Luft; 34: No. 5, 186-189(May 1974). (In German).

1 fig.; 5 tabs.; 5 refs.

Actual radioactive hazards in the city of Wroclaw (Poland) are discussed. Two radionuclides were chosen from many others: ^{90}Sr and ^{137}Cs, that are the most dangerous for men and other living organisms. Based on investigations, a correlation was found between the radioactivity of atmospheric aerosols and that of the fallout. Models established by Martin and Freiling were applied as well. (GE)

32073 MEASUREMENT OF EXTREMELY LOW-LEVEL RADIOIODINE IN AIR. Goldstein, N. P.; Sun, K. H.; Gonzalez, J. L. (Westinghouse Research Labs., Pittsburgh). Nucl. Technol.; 23: No. 3, 328-336(Sep 1974).

The U. S. Atomic Energy Commission is presently considering lowering the limits of radioiodine release from nuclear power plants by a factor of 30,000 below the current levels listed in its Federal Regulations. This proposed limit corresponds to an environmental concentration of 3×10^{-15} μCi/ml of air for ^{131}I, with somewhat similar values for other iodine isotopes. This represents a very small amount of radioactivity, corresponding to ~1 dis/sec in a cube of air 95 ft on a side. Experiments were carried out to determine the lowest radioiodine concentrations that can be measured using high volume collection of air in triethyldiamine-impregnated charcoal and by counting the adsorbed radioactivity with a shielded Ge(Li) counter. For this purpose, concentrations of ^{131}I and ^{133}I were measured in air at the fence line of a large boiling-water-reactor plant and obtained 7.6×10^{-14} and 2.9×10^{-14} μCi/ ml, respectively. In addition, concentration of ^{131}I in the form of fallout at Pittsburgh, Pennsylvania, two weeks after the Chinese nuclear bomb test of June 27, 1973, was found to be 4.6×10^{-15} μCi/ml. The main limitation in the ultimate sensitivity of measurements of this sort lies in the statistical separation of the signal from the background. From the results, it was estimated that ^{131}I and ^{133}I peaks at the proposed U. S. Atomic Energy Commission limit can be separated from the background with standard deviations of 15 and 30%, respectively, using a total of 7 days for collection and counting. The corresponding figures for a modern state-of-the-art Ge(Li) detector were shown to be 7% for ^{131}I and 15% for ^{133}I. In addition, our measurements possess systematic errors totaling ~20%. (auth)

Soil

32074 (ANL-8115) ANNUAL REPORT ON PROJECT ANO115A, FISCAL YEAR 1974. Fried, S. M.; Friedman, A. M.; Quarterman, L. A. (Argonne National Lab., Ill. (USA)). Jul 1974. Contract W-31-109-Eng-38. 12p. Dep. NTIS $4.00.

Three types of measurements relating to the migration of actinide elements in the lithosphere have been performed. These were studies of surface-absorption coefficients, migration coefficients, and transport along the surfaces of fissures. A computer analysis of the fissure experiments indicates that all these phenomena are related and can be understood in terms of surface absorption. In addition, it has been found that at least two migratory forms of plutonium are present. (auth)

32075 (ARH-2761) INPUT AND DECAYED VALUES OF RADIOACTIVE LIQUID WASTES DISCHARGED TO THE GROUND IN THE 200 AREAS THROUGH 1971. Hanson, G. L.; Anderson, J. D.; Kiel, G. R.; McMurray, B. J.; Nisick, N. P. (Centre National de la Recherche Scientifique, 67 – Strasbourg (France). Dept. de Chimie Nucleaire). 22 Mar 1973. Contract AT(45-1)-2130. 62p. Dep. NTIS $6.25.

Low- and intermediate-level liquid wastes from the reprocessing of spent fuel elements have been discharged to the ground at the Hanford disposal sites since 1944. The input valves and radioactivity discharged at each site have been reported but no corrections for radioactive decay were made. In order to provide the decayed inventory of radioactivity discharged to each liquid waste disposal site the annual inputs of liquid volume in

liters, grams of plutonium or ^{233}U, kilograms of uranium, curies of total beta radioactivity, and curies of specific fission products (^{60}Co, ^{90}Sr, ^{106}Ru, ^{137}Cs), to each site, were tabulated and submitted for computerized radioactive decay using computer code DCAY1. Decay calculations were made only on the total beta activity and on the specific fission products. The annual inputs, total inputs and decayed inventory through December 31, 1971 for 200 East Area liquid waste disposal sites and for 200 West Area liquid waste disposal sites are tabulated. (LCL)

32076 (HASL-286, pp I.2-I.10) DEPTH DISTRIBUTIONS OF GLOBAL FALLOUT ^{90}Sr, ^{137}Cs, AND $^{239,240}Pu$ IN SANDY LOAM SOIL. Hardy, E. 1 Oct 1974.

In fallout program.

The first of a series of depth profile soil samples taken at an undisturbed site on Cape Cod, Mass., were analyzed for ^{90}Sr, ^{137}Cs, and $^{239,240}Pu$. Cesium-137 shows the least tendency to migrate downward followed by $^{239,240}Pu$ and ^{90}Sr, in that order. The objective of this experiment was to measure the depth distributions of these isotopes on a bi-annual basis to estimate rate of movement. (auth)

32077 (LA-5716-MS) DISPERSION AND MOVEMENT OF TRITIUM IN A SHALLOW AQUIFER IN MORTANDAD CANYON AT THE LOS ALAMOS SCIENTIFIC LABORATORY. Purtymun, W. D. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1974. Contract W-7405-eng-36. 10p. Dep. NTIS $4.00.

Twenty (20) Ci of tritium discharged into Mortandad Canyon in November 1969 were used to determine the dispersion and movement of the tritium in a shallow aquifier in the alluvium. It took 388 days for the peak concentration to move 3,027 m from the effluent outfall to the eastern end of the aquifer. The concentration decreased from 77,700 pCi/ml to 310 pCi/ml in that distance. Ground water in transit storage contained about 0.9 Ci of tritium prior to the release of the 20 Ci. About 3.9 Ci of tritium remained in transit storage at the end of 1970. The remaining 17.0 Ci were lost with evapotranspiration, infiltration with ground water into the underlying tuff or suspended with soil moisture above the aquifer. (auth)

32078 (WASH-1332(74)(Vol.2), pp 931-947) NEVADA APPLIED ECOLOGY GROUP ENVIRONMENTAL STUDIES OF PLUTONIUM. White, M. G.; Dunaway, P. B. (Atomic Energy Commission, Las Vegas, NV). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

The plutonium program of the Nevada Applied Ecology Group is conducted on the Nevada Test Site (NTS), Tonopah Test Range (TTR), and surrounding areas. Objectives of this relatively comprehensive ecological program are to (1) delineate locations of plutonium contamination, (2) determine concentrations in ecosystem components, (3) quantify rates of movement among those components, (4) evaluate radiological hazards of plutonium in organisms, (5) identify areas that need to be cleaned up or treated, and (6) develop techniques for cleanup or treatment. Results indicate that measurable concentrations of plutonium are not being moved now by resuspension of NTS or TTR, but that resuspended plutonium is present in areas close in to "ground zeros." Plutonium concentrations in undisturbed soil decrease with depth, but plutonium is not uniformly distributed in the particle-size fractions within soil samples. At present, and for several hundred years, ^{241}Am may be of more concern than ^{239}Pu. Relatively uniform concentrations of ^{239}Pu and ^{241}Am were found for each plant species, but considerable variation in concentrations was found among species. Field populations of microorganisms varied considerably from site to site. Plutonium in Aspergillus spores was about one-fourth that in a growth medium. Addition of bile and changes in pH in an artificial digestive tract caused sharp rises in solubility of plutonium nitrate, citrate, and dioxide. Plutonium levels in tissues of small mammals residing on contaminated areas were only two orders of magnitude less than concentrations in their gastrointestinal tracts and pelts. Transfers of plutonium to cattle tissues varied according to form of plutonium and mode of administration. Preliminary results from a comprehensive model indicate that some areas on NTS would have to be cleaned up or treated before constant habitation by people could be permitted. (auth)

32079 MODEL EXPERIMENTS ON THE DOWNWARD MIGRATION OF ARTIFICIAL RADIOACTIVE MATERIALS IN SOILS. Rohleder, K. (Staatliches Chemisches Untersuchungsamt, Braunschweig (F.R. Germany)). Kerntechnik; 15: No. 7, 301-305(1973). (In German).

5 figs.; 2 tabs.; 15 refs.

The distribution of various nuclides in certain types of soil and the dependence of this distribution on the distribution coefficients of the nuclides, the exchange capabilities of the soils, the percolation time, the pH of the percolating water, and the vegetation cover are reported. Estimates are presented of the reduction of the dose rate on the soil surface with time, taking into account the nuclide distribution, the radiation absorption and nuclide decay. (auth)

32080 EVIDENCE OF SEASONAL EFFECTS ON ENVIRONMENTAL RADIOACTIVITY. Brown, R. C. (Washington State Univ., Pullman). J. Environ. Sci.; 17: No. 5, 25-26(1974).

Analysis of data from radioactivity determinations of plant samples from the environmental surveillance program at the Washington State University Nuclear Radiation Center, Pullman, Washington indicated a significant decrease in specific radioactivity for the March through September period of calendar years 1965 through 1970. A similar analysis of data from radioactivity determinations of soil samples from the same environmental surveillance program did not indicate a seasonal variation. This seasonal effect on plant radioactivity in the vicinity of a particular nuclear facility should be determined for that particular facility. Once this effect is known, the environmental impact of the release of radioactive materials from this facility would be operationally easier to assess. (auth)

32081 POSSIBLE INTRODUCTION INTO THE SOIL OF RADIOSTRONTIUM IN SOIL FERTILIZATION WITH SLUDGE FROM BIOLOGICAL SEWAGE TREATMENT PLANTS. Il'in, B. N. (Leningrad Scientific Research Inst. of Radiation Hygiene). Gig. Sanit.; No. 7, 102-104(Jul 1974). (In Russian).

During the processing of sewage in biological processing plants, operating up to conditions of economic utility in agriculture, radioactive Sr is concentrated by factors of tens and hundreds. (tr-auth)

32082 DEPENDENCE OF NATURAL RADIOACTIVITY OF THE SURFACE LAYER ON SOIL CONDITIONS. Teneva, M. Khidrol. Meteorol.; 21: No. 5, 35-39(1972).

The dependence of the natural radioactivity of the surface layer on the soil conditions is investigated. During all seasons it is established a clearly expressed tendency of decrease in the concentration of the natural radioactivity in the surface air layer, with the increase in soil moisture, the minimum being observed when the earth's surface is altogether under snow cover. This is due to the fact that in dry soil the exhalation of radon is most intensive; in humid and wet soil this exhalation decreases owing the filling up of soil capillaries with water and in snow cover this exhalation strongly decreases and in certain cases it can cease altogether. A dependence is also found between the natural radioactivity of the surface layer and the thickness of the snow cover, namely, with the increase in the latter the natural radioactivity of the surface layer diminishes. With the increased thickness of the snow cover, the exhalation of radon also diminishes. The obtained relationships are shown graphically. (Abstr. Bulg. Sci. Lit., Math., Phys., Astron., Geophys., Geod.)

Water

Refer also to abstract 31693.

32083 (AD-777440) LEVEL OF ^{90}Sr AND ^{137}Cs IN THE WATERS OF THE BALTIC SEA IN 1970. Translated from At. Energ. (USSR); No. 4, 835-838(1972). 11p. NTIS $4.00.

The paper presents the results of a radiochemical determination of the concentrations of ^{90}Sr and ^{137}Cs in a number of regions of the Baltic Sea. Water samples were taken during the second voyage of the Akademik Vernadskiy Scientific Research Ship which sailed from Leningrad. (GRA)

32084 (ANL-8060(Pt.3), pp 85-89) RESIDENCE TIMES FOR ^{239}Pu AND ^{137}Cs IN LAKE MICHIGAN WATER. Wahlgren, M. A.; Nelson, D. M. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

Study of the long-term behavior of ^{239}Pu and ^{137}Cs in natural waters is simplified by working on a lake that is essentially a closed system, located where adjacent land fallout measurements are available. Lake Michigan meets both criteria, with an outflow only about 1% of lake volume each year, and with fallout monitoring stations nearby at Argonne, Illinois, and Green Bay, Wisconsin. The determination of the removal rate of the fallout input from the water column, and of the fraction remaining in the water column, requires knowledge of both the cumulative fallout and the relative annual inputs. The latter is readily obtained from ^{90}Sr measurements in rainfall pots on land, but the uncertainty in the cumulative total for ^{90}Sr on land has been estimated as several tens of percents. The relative amounts of rainfall on Lake Michigan and

on nearby land differ by less than 10%. Extensive lake-wide sampling carried out in June 1972, established the inventory of ^{239}Pu, ^{137}Cs, ^{90}Sr, and ^{3}H in the water column of Lake Michigan at a season when it should be well mixed. The results of the analyses confirmed that this was indeed the case. For ^{90}Sr, the mean lake value from our experimental measurements was 0.81 pCi/l. Based on the average of Green Bay and Argonne ^{90}Sr fallout estimates from precipitation monitoring, the predicted 1973 concentration in Lake Michigan is 0.71 pCi/l, assuming the contribution to the lake from land runoff to be 2%/yr, and loss of outflow and by incorporation to the sediments to equal 2%. The difference between the measured and calculated values may be due to dry deposition; the degree of agreement is encouraging in that an input inventory by direct measurement cannot readily be made for the three lower Great Lakes where residence times are much shorter. The cumulative fallout input of ^{137}Cs to Lake Michigan can now be deduced fairly rigorously, since the ratio of ^{137}Cs to ^{90}Sr is fixed in the fission processes. (CH)

32085 (BNWL-1722) GRAPHIC DISPLAY OF THREE-DIMENSIONAL SURFACES USER'S MANUAL. Friedrichs, D. R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1972. Contract AT(45-1)-2130. 27p. Dep. NTIS $5.45.

For Atlantic Richfield Hanford Co., Richland, WA.

This document describes a program written to output three-dimensional surfaces onto a cathode ray tube (CRT) display. Through the use of orthogonal transformations surfaces can be rotated to provide more complete visualization of the physical characteristics of data being analyzed. The form of the data to be displayed may be a matrix of values representing a surface or a series of lines representing the edges of a three-dimensional object. Minor additions to the program allow displays of surfaces described by a mathematical function. (auth)

32086 (DP-1370) RADIOACTIVITY FROM SRP OPERATIONS IN A DOWNSTREAM SAVANNAH RIVER SWAMP. Marter, W. L. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Sep 1974. Contract AT(07-2)-1. 51p. Dep. NTIS $4.00.

Approximately 25 curies of ^{137}Cs, less than 1 curie of ^{60}Co, and trace amounts of ^{90}Sr were deposited in about two square miles of swamp bordering the Savannah River and adjacent to the southeast Savannah River Plant boundary. Most of the radioactivity was released to on-site streams in the 1960's from reactor area irradiated fuel storage basins. During the period of release, annual average ^{137}Cs concentration in on-site streams never exceeded 3.0% of the concentration guide of 2×10^{-5} μCi/ml, and concentrations in the Savannah River never exceeded 1% of the guide. Most of the radioactivity in the off-site swamp is associated with kaolin clay particles deposited in the the swamp during river flooding which occurred about 23% of the time each year. Gamma exposure rates in the affected area of the off-site swamp range from 30 to 590 mR/year above background. The swamp is uninhabited, and the most likely incremental radiation dose (above background) to hunters and fishermen who spend from a few hours to several hundred hours in the swamp would range from less than 1 mR to a few tens of mR per year. No restrictions on use of the swamp are considered warranted nor are remedial actions needed. The contaminated sediments are relatively immobile and are expected to remain so. Releases of radioactivity to on-site streams were sharply reduced following 1969 when improvements were made in reactor effluent control. No increase in exposure rates is expected from current releases of radioactivity. However, the swamp will be monitored periodically in the future to provide a basis for continued evaluation. (auth)

32087 (GSF-R-53) INSTITUTE FOR RADIOHYDROMETRIE: ANNUAL REPORT 1970. (Gesellschaft fuer Strahlen- und Umweltforschung m. b. H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Radiohydrometrie). Apr 1971. 189p. (In German).

The systematic investigation of the hydraulic properties of filter had a particularly good permeability and low resistance of free flow due to filtering. The permeability of the gravel-coated filter is a function of the prameability, the wall strength of the filter pipe and the coated synthetic bound gravel filter. The relation between permeability and particle size distribution in the gravel sands of Bavaria (Oberbayern) was examined. The natural tritium content in water samples and the enrichment and measuring techniques were further investigated. On surface water of Oberbayern, deuterium and ^{18}O contents were measured. In Chile, rainfall and snow tests were begun. A new apparatus for extracting water samples from particular depths and a process for measuring the fluorescent dye in water with the help of labelled tests are described. The new probe is a considerable time saver with improved measuring of groundwater flow in filter depth gauges. Hydrologic investigations were continued in the river Asse, flow measurement according to the dilution process were tried out with continuous labelling in flumes with strongly varying water flow. New information on the melting of glaciers gave values of T, D, and ^{18}O content. (GE)

32088 (HASL-286, pp I.82-I.89) FALLOUT ^{90}Sr IN THE OCEANS. Volchok, H. L. 1 Oct 1974.

In fallout program.

Atlantic Ocean concentration depth profiles continue to suggest greater ^{90}Sr deposition, per unit area, than for adjacent land bodies. Extrapolating from this to all oceans results in much more ^{90}Sr than was reportedly produced. The pertinent land, atmospheric, and oceanic evidence is reviewed. (auth)

32089 (ORNL-EIS-74-69) HEAVY METALS AND OTHER TRACE ELEMENTS IN AQUATIC ENVIRONMENTS. Corrill, L. S.; Copenhaver, E. D.; Leland, H. V. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 159p. Dep. NTIS $11.00.

A bibliography of 527 items is presented on transport and concentrations of trace elements in aquatic environments and the effects of metallic contaminants of particular interest in water pollution control and aquatic life preservation. Key words are included for all items and abstracts are included in some cases. Author and keyword indexes are included. (HLW)

32090 ^{137}Cs TO ^{90}Sr RATIOS IN THE ATLANTIC OCEAN, 1966 THROUGH 1972. Bowen, V. T. (Woods Hole Oceanographic Inst., MA); Noshkin, V. E.; Volchok, H. L.; Livingston, H. D.; Wong, K. M. Limnol. Oceanogr.; 19: No. 4, 670-681(Jul 1974).

Ratios of ^{137}Cs to ^{90}Sr are summarized from analyses of a large number of seawater samples collected in and about the Atlantic Ocean from 1966 to 1972 at various depths. Analytical comparisons by the participating laboratories are presented. In open-ocean surface samples the mean ratio is 1.43, and in subsurface samples containing no less than 5 dpm ^{137}Cs per 100 liters the mean is 1.44; in subsurface samples containing less than 5 dpm ^{137}Cs per 100 liters, the mean is 1.64. No trend in this ratio with time can be seen, nor can any systematic difference be seen between North Atlantic, South Atlantic, or Mediterranean samples. Agreement of the various open-ocean ratios with that predicted in fallout, 1.45, is excellent. In nearshore samples from several different areas however the mean ratio is 1.07. Material balance and other considerations seem to preclude simple selective loss of ^{137}Cs to the sediments. A number of other processes are available, nearshore, for reducing the ^{137}Cs : ^{90}Sr ratio, but it is not now possible to evaluate their relative importance, nor to explain why their action should result in about the same ratio in so many different nearshore environments. (auth)

32091 URANIUM CONTENT OF DRINKING WATERS FROM THE CENTRAL WATER SUPPLY SYSTEM IN GABROVO AND RUSSE DISTRICTS AND ITS BEARING ON THE CHEMICAL COMPOSITION OF THE WATER. Peeva, S. Letop. Khig. Epidemiol. Inst.; 6: No. 37, 109-114(1972). (In Bulgarian).

A study of the calcium, magnesium, sulphate, and uranium content of drinking waters in two districts of different altitudes above sea level (Gabrovo 600 m, Russe 30 m) showed that the water supplies of Gabrovo district have a 2.9 times lower uranium content than those of Russe district. Direct proportional relationship (as shown by data available in the literature) between calcium, magnesium, and uranium content could not be established. The correlation between sulphate and uranium for waters in Gabrovo district is inversely proportional and corresponds to data in the literature. No such relationship was demonstrable for the water supplies in Russe district. (Abstr. Bulg. Sci. Med. Lit.)

Ecosystems and Food Cycles

Refer also to abstracts 31534 and 32444.

32092 (ANL-8060(Pt.3)) RADIOLOGICAL AND ENVIRONMENTAL RESEARCH DIVISION ANNUAL REPORT, JANUARY-DECEMBER 1973. (Argonne National Lab., Ill. (USA)). 1973. Contract W-31-109-eng-38. 187p. Dep. NTIS $7.60.

Separate abstracts were prepared on the 26 sections of this report. (CH)

For abstracts of individual sections see: 31530, 31531, 32084, 32093-32098, 32106, 32131-32139, 32191-32194, 32230, 32286, and 32418.

32093 (ANL-8060(Pt.3), pp 1-5) GREAT LAKES RADIOECOLOGY PROGRAM: INTRODUCTION. Marshall, J. S., Edgington, D. N.; Wahlgren, M. A. 1973.

In Radiological and Environmental Research Division annual report, January-December 1973.

The Great Lakes Radioecology Program has the ultimate goal of understanding and predicting the biogeochemical behavior and pathways to man of radionuclides and toxic trace elements in Lake Michigan. During 1973 the objective was to measure and assess the distribution of selected natural and long-lived artificial fallout radionuclides in water, sediments, and biota with important roles in their ecosystem cycling and food chains leading to man. As of June 1973, there were seven US nuclear power reactors in operation in the Great Lakes Basin. Because of projected increasing use of Pu in present-day reactors, future breeder reactors, and other applications, studies initiated in 1972 on the behavior of fallout Pu in Lake Michigan were intensified during 1973 and expanded to obtain comparative data on the other Great Lakes. Sampling programs included the collection of water, plankton, fish, and sediment samples at various depths. Approximately 70 samples of Cladophora were collected for an assessment of its potential value as a biological monitor for radionuclides in the Great Lakes. Plutonium measurements to date indicate that the very small fraction of fallout Pu remaining in Lake Michigan water exhibits surprisingly conservative properties, although a pronounced annual depletion and return is observed in the surface waters, and the concentration of Pu in Lake Michigan phytoplankton is several thousand times higher than that in the water, but it decreases by approximately an order of magnitude with each successive link in the food chains leading to man. Measurements of the vertical profiles of fallout ^{210}Pb and ^{137}Cs in sediment cores were used to determine recent sedimentation rates in Lake Michigan. These rates, which are the same as the average over the last 7,000 years, are being used to interpret the distribution of possible pollutants in sediment cores in relation to physicochemical processes and atmospheric and stream inputs. (CH)

32094 (ANL-8060(Pt.3), pp 18-26) PLUTONIUM IN LAKE MICHIGAN PLANKTON AND BENTHOS. Yaguchi, E. M.; Nelson, D. M.; Marshall, J. S. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

Because of the well-known toxicity of Pu and its projected increasing use in power generation and other applications the Pu-concentrating properties of Lake Michigan plankton and benthos were studied because of their importance in food chains leading to man. Plankton was examined in greater detail because of its possibly significant influence on Pu concentrations in municipal water supplies. Fallout ^{239}Pu was used as a tracer. Data are also included on the distribution of ^{137}Cs and other γ-emitting radionuclides. (CH)

32095 (ANL-8060(Pt.3), pp 27-31) PLUTONIUM IN LAKE MICHIGAN FISH. Waller, B. J.; Nelson, D. N.; Marshall, J. S. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

With the current trend of increasing production and use of Pu isotopes, more research is being directed toward understanding the behavior of Pu in the environment. Results are presented from a study of Pu in Lake Michigan fish. The purpose of the study was to provide a preliminary assessment of the potential for food chain transfer of Pu to man, with emphasis on major commercial and sport fish species and dominant forage fish in Lake Michigan. In order to study food chain relationships, emphasis was directed toward analysis of those species that have fairly well-known feeding habits. Fallout ^{239}Pu and ^{137}Cs were used as tracers. The ^{239}Pu and ^{137}Cs concentrations, the ^{137}Cs:^{239}Pu ratios, and the ^{239}Pu concentration factors for fish samples analyzed during 1973 are presented. For the food chains consisting of zooplankton to planktivore to piscivore, and of benthic invertebrates to bottom feeding fish there was approximately a tenfold decrease in ^{239}Pu concentration in each successive link. This decrease along the food chain is consistent with low assimilation efficiency for Pu in fish, as is observed in other vertebrates. (CH)

32096 (ANL-8060(Pt.3), pp 32-35) PLUTONIUM AND OTHER RADIONUCLIDES IN BIOTA NEAR THE BIG ROCK POINT NUCLEAR PLANT. Yaguchi, E. M.; Nelson, D. M.; Marshall, J. S. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

A study was made to determine if certain Lake Michigan biota, acting as biological monitors, indicate increased Pu concentrations which can be attributed to the Big Rock Point Nuclear Plant, Charlevoix, Michigan. Radioactive releases from the Big Rock Point Plant are a source of ^{137}Cs, ^{134}Cs, ^{65}Zn, and ^{60}Co in Lake Michigan and their distribution in biota near this reactor has been studied. Other isotopes including ^{7}Be, ^{95}Zr, ^{106}Ru, ^{239}Pu and also ^{137}Cs are commonly detected in atmospheric fallout and are found in biota throughout the lake. Results are reported from a survey of the distribution of radionuclides from both these sources, with emphasis on ^{239}Pu. Samples of crayfish (Orconectes sp.), green algae (Cladophora sp. and Chara sp.), and the aquatic macrophyte (Potamogeton sp.) were collected at various distances from the Big Rock Point Nuclear Plant and analyzed for ^{239}Pu, ^{137}Cs, ^{134}Cs, ^{106}Ru, ^{95}Zr, ^{65}Zn, ^{60}Co, and ^{7}Be. The concentrations in biota of reactor-produced isotopes showed differing rates of decrease with increasing distance from the discharge. This decrease of concentration with distance for ^{137}Cs, ^{134}Cs, ^{60}Co, and ^{65}Zn, was in contrast to the apparent independence of distance for ^{239}Pu. It is postulated that the differences among the reactor-produced isotopes may result from their existence in varying physicochemical states and/or from differences in their respective biological turnover rates. The apparent dilution rate is slower for ^{137}Cs than for ^{134}Cs, probably because there is a substantial background concentration of ^{137}Cs from fallout. No evidence for the release of significant amounts of Pu from the Big Rock Point Plant was seen in the biological monitors. (CH)

32097 (ANL-8060(Pt.3), pp 90-92) EVIDENCE OF AN ANNUAL PLUTONIUM CYCLE IN THE NEAR-SURFACE WATERS OF LAKE MICHIGAN. Wahlgren, M. A.; Nelson, D. M. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

The rapid depletion of ^{239}Pu from the surface waters of Lake Michigan during July and August, the concurrent changes in the season, and the demonstrated preferential sorption of fallout ^{239}Pu over ^{137}Cs by net plankton all suggest that a biological mechanism is the major removal step in a cycling process involving Pu and may contribute to the eventual removal of this element to the sediments. (CH)

32098 (ANL-8060(Pt.3), pp 93-98) PLUTONIUM IN THE FIVE GREAT LAKES: COMPARISON OF SURFACE WATERS. Wahlgren, M. A.; Nelson, D. M. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

Studies of the fallout radionuclides ^{239}Pu, ^{137}Cs, and ^{90}Sr in Lake Michigan demonstrated that a homogeneous distribution can be found throughout the water column following the winter mixing period, provided that the input of new fallout radioactivity is low as was the case in 1972 and 1973. Assuming that generally similar mixing behavior prevails in all the Great Lakes, surface water and plankton samples were obtained during May and June, 1973, and analyzed for ^{239}Pu, ^{137}Cs, ^{90}Sr, and ^{125}Sb as an indicator of recent fallout. The results of the interlake comparison study are consistent with the results of more detailed studies on ^{239}Pu and ^{137}Cs in Lake Michigan, indicating that the major fraction of both of these fallout isotopes has been removed relatively rapidly to the sediment, and suggesting that the average cumulative deposition rate in sediments will approximate that on land for all five Great Lakes. (CH)

32099 (CEA-R-4599) SOME OBSERVATIONS ON ^{137}Cs CONTAMINATION OF BEEF MEAT FOR THE ARMY (1966–1973). Mercier, F. J.; Lebert, F.; Lemaire, G. G.; Madelmont, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Aug 1974. 50p. (In French). Dep. NTIS (US Sales Only) $5.50.

The contamination by ^{137}Cs of beef meat for the Army was measured systematically in several areas in France, from late 1966 till 1972. Sampling and γ radioactivity measurements are described, the emphasis being set on the importance of the methodology of sampling which must be perfectly adapted to the purpose. No correlation was found between meat and milk contamination levels. Some particular results, especially in Auvergne, led to more basic research on the function of the organic matter of the soil of mountain pastures on ^{137}Cs uptake by forage crops. Such a study, limited to the case of ^{137}Cs, could be extended to other elements or compounds, whether radioactive or not. (FR)

32100 (CEA-R-4618) STRONTIUM-90 LEVELS IN HUMAN BONES COLLECTED IN 1973. Jeanmaire, L.; Patti, F.; Gros, R. (CEA Centre d'Eutdes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Oct 1974. 10p. (In French). Dep. NTIS (US Sales Only) $4.00.

^{90}Sr levels as well as some values for stable strontium in human bones collected in the Paris area during 1973 are presented. There is a general trend towards a decrease of radioactive contamination as compared with last year. (auth)

32101 (HASL-286, pp I.36-I.52) FALLOUT ^{239,240}Pu IN DIET. Bennett, B. G. 1 Oct 1974.

In fallout program.

Ingestion intake of fallout ^{239,240}Pu in New York in 1972 was determined from a complete diet sampling. Concentration of Pu in the 19 food categories ranged from .01 pCi/kg in shell fish to below the minimum detection level in milk. Annual in-

take in total diet was estimated to have been 1.5 pCi in 1972. Further analyses of Pu in wheat have been completed, and an uptake estimate is made for Pu in potatoes. Recent results for Pu in tap water are also reported. (auth)

32102 (WASH-1332(74)(Vol.1), pp 193-260) BIOLOGICAL IMPACTS OF AEC ROCKY FLATS PLANT WASTES DISCHARGED TO SURFACE WATERS. Volume I. Zillich, J. A. (Dow Chemical U.S.A., Golden, CO). 30 Apr 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

Nutrients discharged to surface waters from the Rocky Flats Plant caused algae growth increases as much as 35 times above ambient conditions. Such nutrient discharges if continued could eventually cause taste and odor problems in the water supply for the City of Broomfield. Macroinvertebrate populations in plant drainage systems indicated the waste waters were not very toxic. In comparison to other macroinvertebrate populations in other Denver area waters, Rocky Flats drainages were of much better quality. Fish not only live in all plant drainages but also have been observed reproducing. No plant materials showed any significant bioconcentration in the aquatic food chain. These include chlorinated hydrocarbons, plutonium, and tritium. Radiation exposure to Broomfield residents from Rocky Flats products in city drinking water supplies during 1973 was less than 4 millirem. Broomfield residents received more than 50 times that amount from natural sources, therefore, the amount attributed to the Rocky Flats Plant was small in comparison and was not felt to be a public health hazard. (CH)

32103 (ZAED-BIBL.-02-13) BIBLIOGRAPHIES IN NUCLEAR SCIENCE AND TECHNOLOGY. Section 02: Contamination and Decontamination of Foods. Number 13. Fischer, E. (comp.). (Zentralstelle fuer Atomkernenergie-Dokumentation, Leopoldshafen (F. R. Germany)). Aug 1974. 30p. Dep. NTIS (US Sales Only) $4.50.

A computer-prepared bibliography of 126 items on contamination and decontamination of foods is presented. The bibliography is divided into the following subject categories: general aspects, radioecology, and contamination. English language keywords are included for each item. The following indexes are included: conference author, report number, subject, corporation, and journal. (HLW)

32104 DEPOSITION AND RETENTION OF ELEMENTARY IODINE AND METHYL IODIDE IN GRASS. Heinemann, K. (Kernforschungsanlage, Juelich, Ger.); Vogt, K. J.; Angeletti, L. pp 245-259 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

Iodine discharged from nuclear facilities can contaminate man via the critical path constituted by the food chain of air, grass, cow, milk. In order to improve the forecasting of risks to the environment, the authors measured the dry deposition and retention of iodine in grass. To avoid the potential risks associated with the use of radioactive iodine in situ, the experiments were carried out with stable iodine. After determination of the iodine content of the grass and the air, the deposition of elementary iodine on the grass was measured as well as the ratio between the air concentration one meter above the ground, integrated in time, and the grass contamination per unit area. The results are discussed in correlation with the meteorological conditions (wind speed, friction velocity, and type of diffusion) and with the quality of grass (density, age, variety). An additional experiment was performed to investigate the phenomenon of iodine desorption by grass. The preliminary results show a biological half-life of eight days which is apparently unaffected by the precipitations. The deposition on grass of methyl iodide (CH_3I) was also investigated. Since the deposition velocity of methyl iodide is about two orders of magnitude less than that of elementary iodine, the experiments had to be carried out with radioiodine in a closed system. The data obtained were corrected by measurements of iodine (I_2) deposition performed under the same experimental conditions. (auth)

32105 ACCUMULATION AND RETENTION OF ^{65}Zn AND ^{54}Mn BY THE PLAICE, PLEURONECTES PLATESSA L. Pentreath, R. J. (Fisheries Radiobiological Lab., Loestoft, Eng.). J. Exp. Mar. Biol. Ecol.; 12: No. 1, 1-18(Jul 1973).

In the plaice (Pleuranectes platessa) the direct accumulation of ^{65}Zn and ^{54}Mn from water plays only a minor role relative to food in the metabolism of these metals. The accumulation of both isotopes from water was followed at tissue level and their levels of accumulation were related to usable element concentrations. Biological half-times were also calculated for accumulation and loss to water, for loss of activity following i.p. injection, and from food. Some comparative studies were performed with fed and starved fish. In view of the relatively minor role of direct accumulation from water, the concentrations of these metals would probably decrease at this trophic level. The relevance of such observations to toxicity testing is also discussed. (Pollut. Abstr.)

Radiometric Techniques

Refer also to abstracts 31473, 31996, 32027, 32061, 32303, and 32304.

32106 (ANL-8060(Pt.3), pp 39-62) DETERMINATION OF RECENT SEDIMENTATION RATES IN LAKE MICHIGAN USING ^{210}Pb AND ^{137}Cs. Edgington, D. N.; Robbins, J. A. 1973.

In Radiological and Environmental Research Division annual report, January-December 1973.

Natural ^{210}Pb dating appears to be a valid and powerful technique for establishing the age of recently deposited sediments in the Great Lakes. The method gives measures of the sedimentation rates which are essentially in agreement with those derived from more laborious and less exact but established palynological and seismic methods. The ^{210}Pb profile studies to date show an expected exponential shape consistent with the assumption of uniform sedimentation rates over the last several hundred years and of secular equilibrium between supported ^{210}Pb and ^{226}Ra. No evidence was seen for contributions of ^{210}Pb from nuclear detonations. Companion ^{137}Cs profiles indicate that the coring technique was probably recovering the uppermost levels of the deposit and that the mobility of both radionuclides within the sediment is small. (auth)

32107 (IEA-313) RADIOISOTOPIC TECHNIQUES APPLIED TO THE STUDY OF THE AQUIFERS OF THE BASINS OF THE GURGUEIA AND FIDALGO RIVERS, PIAUI. Plata Bedmar, A.; Sanchez, W.; Szulak, C. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Oct 1973. 56p. (In Portuguese). Dep. NTIS (US Sales Only) $5.50.

The possible use of water from the Gurgueia and Fidalgo basins, at Piauí, for irrigation purposes, was studied. Radioisotopic techniques were used, not only because they are cheap, but also because they give fast and reliable results. These techniques serve as a complementation of more general studies realized with conventional techniques. Using different techniques, a radioactive tracer (^{131}I in iodide form) was injected in the wells. By detecting the water radioacivity, it was possible to determine: the appearing vertical fluxes of the artesian wells; the localization and measurement of vertical fluxes in nonartesian wells; the localization and measurement of the horizontal fluxes; and the effective porosity in connection with pumping assays. Along the Rio Gurgueia basin, 3 artesian wells (Cristino Castro, Canto do Buritĭ and Brejo) and 7 nonartesian wells, with vertical ascendent and descendent fluxes (Jerumenha, Bertolinia, Canto do Buritĭ, Eliseu Martins, Laranjeiras and Curimatá) were studied. At the Fidalgo basin, 5 artesian wells (Malhadinha, Lagoa Comprida, alto Novo, Malhada de Dentro and Carro Quebrado) and 2 nonartesian wells with vertical fluxes (Morro dos Cavalos and Babeco) were studied. Horizontal fluxes in 3 wells, were measured and by the knowledge of the underwater velocity at the Serra Grande aquifer the permeability coefficient was calculated. The theoretical aspects of the radioisotopical techniques used and the results obtained are also discussed. (auth)

32108 (IEA-315) STUDIES OF AQUIFERS OF THE GURGUEIA AND FIDALGO RIVER BASINS IN THE STATE OF PIAUI USING ENVIRONMENTAL ISOTOPES. Plata, A.; Sanchez, W.; Szulak, C. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Nov 1973. 46p. (In Portuguese). Dep. NTIS (US Sales Only) $5.50.

Possibilities that surface and underground aquifers were actually connected, localization of the recharge zones, determination of its annual average rate of recharge, water age estimations, mixing of ancient and new water, and the possibility for the Gurgueia and Caninde rivers to drain underground aquifers, were studied by measuring the concentration of environmental isotopes (^3H, ^2H, ^{18}O, and ^{14}C) in 40 water samples. Twenty-seven of the samples were collected from different wells, and the remaining 13 from lagoons. In the last case, the samples were taken from the central region or at the water outlet. Because of the small dimensions of the investigated lagoons, it was assumed that the ^3H concentration was constant throughout the water mass. The possibility that some lagoons were actually connected with subjacent underground reservoirs was investigated by measuring in both aquifers the concentrations

of the stable isotopes ^{2}H and ^{18}O. The river contributions to underground aquifer recharge as a function of the formations lithology was also analyzed through environmental isotopes. (auth)

32109 CHANGES IN ^{18}O AS A MEASURE OF LONG-TERM FLUCTUATIONS IN TROPICAL LAKE LEVELS AND MOLLUSCAN POPULATIONS. Covich, A. (Washington Univ., St. Louis); Stuiver, M. Limnol. Oceanogr.; 19: No. 4, 682-691(Jul 1974).

In Laguna Chichancanab, the largest closed basin in northern Yucatan, large-scale changes in lake levels have been documented by ^{18}O analyses of snail shell carbonates. A continuous 9-m series of lake sediments has been deposited during the last 8,000 years, whereas a discontinuous sedimentary record extends from 9 m to beyond 12 m in depth. At least one marked hiatus occurred in this older record during which time the lake is thought to have been seasonally dry (or very much reduced in size). The fluctuations are verified by other stratigraphic evidence including absolute numbers of shells, loss on ignition, carbon:nitrogen ratios, and major cations (calcium, magnesium, and sodium). (auth)

32110 ABSOLUTE AGE DETERMINATIONS OF ROCKS BY Rb-Sr METHOD. Zinkiewicz, J. M. (Univ. of Lublin). Przegl. Geol.; 21: 251-254(1973).

The Rb-Sr method was applied to estimate absolute ages of granites of Strzelin-Zulova and Strzegom-Sobótka massifs, Przedgórze Sudeckie, a magmatite from Sowie Mts., and a gneiss from Tatra Mts. Relative Sr and Rb contents in these rock were determined by x-ray fluorescence and isotope dilution methods. Separation of Rb and Sr was performed by ion exchange in chromatographical cation columns. Isotope ratios, Rb/Sr, were established by means of 90-degree mass spectrometer CH-5 of the Atlas Co.; the spectrometer works with two-belt two-carrier ion source, and the resulting ion currents are recorded by a single collector. In age determinations, $\beta-$ ^{87}Rb equaling $\Lambda = 1.47 \cdot 10^{-11}$ years^{-1} was accepted as the value of half-life constant, and $^{87}Sr/^{86}Sr = 0.716$ was accepted as the initial value (for the moment of rock formation). The average age of Przedgórze Sudeckie granites is $268 \cdot 10^{6}$ years, that of the examined migmatite, $329 \cdot 10^{6}$ years, and the age of the gneiss, $408 \cdot 10^{6}$ years. The absolute age data previously obtained for the granites of the Przedgórze Sudeckie by the use of K-Ar method by other authors appear to be remarkably consistent with the results presented herein. (auth)

32111 DETERMINATION OF LOCATION OF HYDROLYZED POLYZARYLONITRILE IN LAYERS BY A RADIONUCLIDE TECHNIQUE. Kalashnikov, B. M.; Yusupov, I. G.; Shumilov, V. A.; Khairetdinov, R. Sh. Neftеprom. Delo; No. 3, 19-20(1973). (In Russian).

A method is described for determining the location of hydrolyzed polyacrylonitrile in strata using radioactive isotopes (^{95}Zr, ^{59}Fe, ^{65}Zn). With the method it is possible to qualitatively evaluate the separation of water layers in boreholes. (tr-auth)

32112 RADIOACTIVE ISOTOPES IN EFFECTIVE POROSITY DETERMINATIONS. Wurzel, P. (Rhodesia Univ., Salisbury. Dept. of Geography). Atomkernenergie; 23: No. 4, 275-277(1974). 2 figs.; 1 tab.; 9 refs.

In-situ effective porosity tests were carried out in two geologically different, confined aquifers in Rhodesia using radioisotopes as field tracers. The results are given and are briefly discussed in the light of tests carried out by several other workers. It is shown that the time of tracer peak is the important time parameter. (auth)

32113 APPLICATION OF ISOTOPE METHODS FOR THE INVESTIGATION OF GROUND WATER POLLUTION. Moser, H.; Neumaier, F.; Rauert, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F.R. Germany). Inst. fuer Radiohydrometrie). Z. Dtsch. Geol. Ges.; 124: 501-514 (1973). (In German).

From symposium: groundwater and environment; Essen, F. R. Germany (2 May 1973). 8 figs.; 1 tab.; 33 refs.

Important tasks of environmental protection include: investigation into the distribution of waste products in the hydrosphere in the vicinity of existing and foreseeable waste producers and garbage dumps and study of any detrimental effects on drinking water production installations caused by waste products. The use of isotope methods to solve these problems has been limited until now to determining possible migration paths and velocities of pollutants in ground water. Radioactive tracers added to the ground water have proved of value in measuring filtration velocities and the flow direction of ground water and in investigating the layering of the ground water flow and the aquifer in loose sediments. These radioactive tracers have also been successfully used together with dye tracers to investigate the migration paths and flow times in karst water systems. The determination of the natural content of radioactive isotopes (e.g. ^{3}H, ^{14}C) and stable isotopes (e.g. ^{2}H, ^{13}C, ^{18}O) can supply an insight into the interrelationship between surface water and ground water and into their recharge areas. A comprehensive methodical survey is given of isotope tracer methods with some examples of their application. (auth)

32114 APPLICATION OF OXYGEN AND HYDROGEN ISOTOPE STUDIES TO PROBLEMS OF HYDROTHERMAL ALTERATION AND ORE DEPOSITION. Taylor, H. P. Jr. (California Inst. of Tech., Pasadena). Econ. Geol.; 69: No. 6, 843-883(1974).

$^{18}O/^{16}O$ and D/H analyses of hydrothermal minerals and fluid inclusions can provide data on temperatures and attainment of equilibrium, but they are principally useful as isotopic tracers in determining the origin of the H_2O involved in ore deposition. This results from the fact that different sources of H_2O in the earth's crust, namely primary magmatic, metamorphic, oceanic, connate, and meteoric, all exhibit characteristic δD and/or $\delta^{18}O$ values. Recent studies have provided quantitative data emphasizing the importance of meteoric H_2O in many hydrothermal fluids. Epizonal igneous intrusions emplaced into permeable country rocks (e.g., highly fractured volcanic areas) act as gigantic "heat engines" that set up long-lived hydrothermal convection systems that persist throughout the crystallization and cooling of the intrusion. The amounts of magmatic water in such systems are negligible compared with the very large amounts of heated meteoric ground water. Certain epithermal ore deposits and their associated propylitic alteration zones in volcanic terranes (western Cascades, Tonopah, Comstock, Goldfield, the San Juans) were formed by such low-^{18}O meteoric fluids; the very high water/rock ratios imply that such ore-bearing fluids are relatively dilute water. If the country rocks are less permeable, as in many porphyry copper environments, less outside water is available and dominantly magmatic-hydrothermal fluids are isotopically identified as the source of the biotite-K feldspar alteration in the core zones of the porphyry stocks. A less pronounced meteoric-hydrothermal circulation, perhaps involving Na-Ca-Cl brines in the country rocks, is set up outside the stock. Such solutions are responsible for the pyrite-sericite and hypogene clay alteration zones in the outer portions of the stock. These zones tend to collapse and encroach on the central zone with time and the Cu ore bodies commonly occur near this boundary. At a much later stage, after erosion, supergene clay formation may occur and this can also be distinguished from the hypogene clay alteration by means of $\delta^{18}O$ and δD analyses. (auth)

32115 SULFUR AND CARBON ISOTOPES AND ORE GENESIS: A REVIEW. Rye, R. O. (Geological Survey, Denver); Ohmoto, H. Econ. Geol.; 69: No. 6, 826-842(1974).

Important new developments in carbon and sulfur isotope geochemistry are reviewed with reference to a number of hydrothermal ore deposits that represent a considerable range in age, temperature of deposition, mineralogy, and mode of occurrence. Recent carbon and sulfur isotope studies that have made important contributions to our understanding of ore genesis emphasize that for meaningful interpretation investigations must be coupled with detailed geologic, mineralogic, and other geochemical studies. Under equilibrium conditions, the $\delta^{34}S$ and $\delta^{13}C$ of hydrothermal minerals are determined by the physical chemical conditions of the hydrothermal fluids (T, pH, f_{O_2}) as well as the isotopic composition of sulfur and carbon ($\delta^{34}S_{\Sigma S}$ and $\delta^{31}C_{\Sigma C}$) in the ore fluids. These variables, along with the f_{S_2}, $m_{\Sigma S}$, f_{CO_2} and $m_{\Sigma C}$ of the fluids and the possible mechanism of ore deposition, have been determined in several deposits by combining isotopic and other geochemical data. The important sources of sulfur in ore deposits are deep-seated sources (mantle or homogenized crust), local country rocks, and sea water or marine evaporites. The important sources of carbon are deep-seated sources (mantle or homogenized crust), marine limestones, and organic matter in sedimentary rocks. Discussions of the origin of sulfur and carbon in ore deposits must be based on accurate determinations of $\delta^{34}S_{\Sigma S}$ and $\delta^{13}C_{\Sigma C}$ values which can be greatly different from the $\delta^{34}S$ and $\delta^{13}C$ values of individual minerals in these deposits. In shallow environments where boiling, mixing of fluids, or redox reactions occurred, sulfur isotopic equilibrium may not have been established among hydrothermal minerals and between fluids and minerals. The occurrence of isotopic disequilibrium in such environments, however, may help elucidate the history of hydrothermal fluids. Bacteriogenic sulfide deposits, involving bacteriologic reduction of sea water sulfate can be recognized by their occurrence in nonvolcanic sedimentary environments, by nonequilibrium distribution of sulfur isotopes between coexisting minerals, and by the time-space relationships of their $\delta^{34}S$ (and $\delta^{13}C$) values, but not necessarily by the statistical distribution of their $\delta^{34}S$ values. Bacteria need not be involved in the reduction of sea water sulfate in volcanic environments inasmuch as sulfate may readily be reduced by deep circulation into high-temperature rocks and precipitated as sulfides at lower temperatures in or near sedimentary basins. Preliminary data on metamorphosed stratiform deposits suggest that original large-scale sulfur and carbon isotope distributions are generally preserved during metamorphism making it possible to determine the origin

of sulfur and carbon in such deposits. However, minor changes in the sulfur and carbon isotope systematics that reflect the metamorphic event are often superimposed on the original isotope distributions. (auth)

32116 STRONTIUM ISOTOPES IN ECONOMIC GEOLOGY. Hedge, C. E. (Geological Survey, Denver). Econ. Geol.; 69: No. 6, 823-825(1974).

Variable increments of radiogenic ^{87}Sr relative to nonradiogenic Sr can be used as a natural tracer of geologic processes. There has been only limited application of this tracer to economic geology; however, some data suggest that igneous rocks associated with ore deposits may include a high proportion of crustal material and that the strontium in hydrothermal veins seems to have been derived not far from its site of deposition. (auth)

32117 TANZAWA PUMICE FOUND IN THE WESTERN PART OF YOKOHAMA CITY AND THE ^{14}C AGE OF THE PEAT SEAM DIRECTLY UNDERLYING IT. The ^{14}C Age of Quaternary Formation in Japan. Chikyu Kagaku; 28: No. 1, 49-50(Jan 1974). (In Japanese).

On July 9th, 1972, a pumice seam was discovered well preserved in the Tachikawa loam beds in the western part of Yokohama City near Hodogaya bypath of No. 16 highway. This pumice was identified as the Tanzawa Pumice (TnP) which had been known in southern Kantō west of the Sagami River as being intercalated in the Tachikawa loam beds as a seam of white volcanic ash and forming an important key-bed. Since, in the present locality, it is found in an alternating portion of scoria and peat seams of the Tachikawa loam, the ^{14}C age of the peat seam directly underlying the pumice was determined, and its value was 21,220 ± 670 y.B.P., which coincides with the age previously estimated by H. Machida et al. for the TnP in the original province (some 21,000-23,000 y.). The pumice seam in the present locality is about 10 cm in thickness, and is seen continuing for more than 10 m. It consists almost entirely of very fine, white volcanic glass. About 1 m below the TnP, there is the base of the Tachikawa loam beds which uncomformably covers the Musashino loam beds accompanied by Tōkyō Pumice. In this locality, the lower half of the Tachikawa loam beds is lacking. (JA)

32118 APPLICATION OF LEAD ISOTOPES TO THE PROBLEMS OF ORE GENESIS AND ORE PROSPECT EVALUATION: A REVIEW. Doe, B. R.; Stacey, J. S. (Geological Survey, Denver). Econ. Geol.; 69: No. 6, 757-776(1974).

Lead isotope data are now available not only for ores but also for cryptic rock leads from ultrabasic, oceanic and continental volcanic, granitic, metamorphic, oceanic-pelagic, and continental sedimentary rocks. The data show great application to problems of ore genesis and great promise in ore prospect evaluation. In ore genesis, the major applications are in defining the source material for the lead in the ores and in determining an estimate of the age of mineralization. As an example of each application, isotopic studies have shown that the lead in the Phanerozoic galena ores of southeast Missouri has been mainly from a Cambrian sandstone aquifer unit and perhaps partly the Precambrian basement and Paleozoic carbonate host rock units (in agreement with a lateral secretion hypothesis) and that the age of the bulk of the ores in the Coeur d'Alene district in Idaho now is established as Precambrian, whereas some scientists previously had thought the deposit to be Cenozoic. Applications to ore prospect evaluation are as follows: Most major base-metal ore deposits of the world have characteristic lead isotope ratios and many appear to have lead isotopic compositions that evolved under conditions approximating single-stage conditions. Under these conditions no changes would have occurred in the value of U/Pb and Th/Pb in the source of the ores, since the formation of the earth, other than those resulting from radioactive decay of uranium and thorium. Many minor deposits appear to have leads not evolved under these conditions. This difference in lead isotopic composition between major and minor ore deposits provides an isotopic tool for ore prospect evaluation anywhere in the world. A refined application involves "fingerprinting" the lead of a prospect for matching with that of a producing deposit in the same district, because different producing deposits within a district often have similar lead isotope compositions. The application extends the use of lead isotopes in ore prospect evaluation to certain major ore deposits that have anomalous leads, such as those of the Mississippi Valley. The leads in the high-temperature copper ores of Utah are similar in isotopic composition to leads in the igneous rocks, and the leads in the low-temperature lead-zinc-silver ores at Creede, Colorado, have characteristics that must be related to underlying Precambrian country rocks, which suggest that the lead isotopic composition might parallel the zoning of the ore metals in a district. (auth)

32119 EVALUATION OF K-Ar ISOCHRON METHODS. Shafigullah, M.; Damon, P. E. (Univ. of Arizona, Tucson). Geochim. Cosmochim. Acta; 38: No. 9, 1341-1358(Sep 1974).

The K-Ar isochron method is an attempt to obtain the initial age or reset age and the extraneous argon isotopic ratio of a suite of cogenetic samples of different K-contents. Some samples contain excess argon-40 and others lose argon-40. The resultant ages on single samples are not significant geologically. The principles are discussed of three types of isochrons commonly used, the ^{40}Ar vs ^{40}K isochron, the $^{40}Ar/^{36}Ar$ vs $^{40}K/^{36}Ar$ isochron, and the $^{40}Ar/^{36}Ar$ vs $^{39}Ar/^{36}Ar$ isochron, and the first two types are evaluated for ten different hypothetical cases. If a straight line is obtained in the ^{40}Ar vs ^{40}K isochron, a positive intercept indicates an approximately constant amount of excess argon, whereas a negative intercept indicates argon loss. A curved line or scattering of points indicates that the basic assumptions are not valid for the set of samples under consideration. The $^{40}Ar/^{36}Ar$ vs $^{40}K/^{36}Ar$ isochron method is valid, rigorously, only when all samples of the system under consideration have the same nonradiogenic argon isotope composition. This requires that either no excess argon is present in the system, or else each analysis contains the same proportion of excess and atmospheric argon. If these conditions do not hold, approximately, invalid ages and invalid intercepts are obtained. Any K-Ar isochron needs to be used with caution. (auth)

Site Surveys

Refer also to abstracts 32018, 32031, 32034-32036, 32042, and 34312.

32120 (BNWL-B-360) SELECTED WATER TABLE CONTOUR MAPS AND WELL HYDROGRAPHS FOR THE HANFORD RESERVATION, 1944-1973. Kipp, K. L.; Mudd, R. D. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 640p. Dep. NTIS $35.00.

Two sets of hydrologic data for Hanford area are graphically presented. The first consists of 14 groundwater contour maps derived from data acquired from 1944 to 1974. The second is a set of historical well hydrographs for the Hanford Reservation wells starting with 1948 data. More than 600 pages of hydrographs on each well for which more than two water level measurements have been taken are included. (LCL)

32121 (CONF-730505-, pp 399-413) BIOLOGICAL MONITORING IN WHEELER RESERVOIR BEFORE OPERATION OF BROWNS FERRY NUCLEAR PLANT. Taylor, M. P. (Tennessee Valley Authority, Muscle Shoals, AL). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

In a pilot study of nonradiological conditions in Wheeler Reservoir before operation of the Browns Ferry Nuclear Plant, plankton and benthic samples were collected randomly on a quarterly sampling basis from eight stations (24 transect points) from 1969 through 1972. Benthic components must be analyzed separately by selected locations where they thrive. Cross-section transect sampling can be used as random sampling by location (location is not necessarily restricted to one river mile or one transect point). Seasonal effects are extreme in the benthic fauna for Chironomidae and Hexagenia but not for Corbicula. Plankton also exhibit noticeable seasonal variations. Seasonal effects existing during preoperational monitoring will be compared with those existing during postoperational monitoring. (auth)

32122 (CONF-730505-, pp 448-461) ECOLOGICAL BASE-LINE STUDY OF THE FISH OF THE ANCLOTE ANCHORAGE. Rolfes, J. K.; Feinstein, A.; Dietz, R. A.; Milliken, D. M.; Baird, R. C.; Fable, W. A.; Causey, B. D. (Univ. of South Florida, St. Petersburg). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

A fossil-fuel power plant is presently under construction at the mouth of the Anclote River on the west coast of Florida. As part of the Anclote Environmental Project (a study to gather base-line data) a multigear sampling strategy for fish has been developed by the Department of Marine Science of the University of South Florida. Preliminary results indicating patterns of variation in density, diversity, and species composition with respect to time, habitat, and sampling method are presented and discussed. (auth)

32123 (COO-3279-11) PHYTOPLANKTON UTILIZATION OF NITRATE, NITRITE, AMMONIUM, AND UREA NITROGEN IN THE CHESAPEAK BAY. McCarthy, J. J.; Taylor, W. R. (Johns

Hopkins Univ., Baltimore, Md. (USA). Chesapeake Bay Inst.). 1974. Contract AT(11-1)-3279. 23p. (CONF-740647-2). Dep. NTIS $4.25.

From 37th meeting of American Society of Limnology and Oceanography; Seattle, Washington, USA (26 Jun 1974).

Patterns observed in the distribution and phytoplankton use of nitrogeneous nutrients in the Chesapeake Bay are discussed. Results of a thirteen-month study comprising two-week cruises at eight-week intervals are presented. (JRD)

32124 (COO-3292-10) SEDIMENT-WATER EXCHANGE IN CHESAPEAKE BAY. Bricker, O. P. III; Troup, B. N. (Johns Hopkins Univ., Baltimore, Md. (USA). Dept. of Earth and Planetary Sciences). 1973. 45p. (CONF-731086-1). Dep. NTIS $5.25.

From 2nd international estuarine research conference; Myrtle Beach, South Carolina, USA (15 Oct 1973).

In Chesapeake Bay, diagenetic reactions in the sediment-interstitial water environment result in the enrichment of many dissolved species relative to their concentrations in the overlying water. Rapid exchange of dissolved species across the sediment-water interface in response to physical and chemical processes leads to the establishment of strong gradients in these species in the upper meter of the sediment column. In spite of the non-equilibrium nature of the overall system, the concentrations of species that participate in reactions whose time scales are rapid relative to their transport through the system, can be adequately described in terms of equilibrium models. The concentrations of chemically non-reactive dissolved materials and species that are involved in slow reactions relative to movement through the system, must be modeled on the basis of non-equilibrium diffusional transport. (auth)

32125 (EGG-1183-1639) EFFECTIVENESS OF PHOTOGRAPHIC REMOTE SENSING IN EVALUATING LAND USE. Wright, D.; Rhoads, W. A.; Michael, J. A. (EG and G, Inc., Los Alamos, N. Mex. (USA)). 1974. Contract AT(29-1)-1183. 12p. (CONF-740928-1). Dep. NTIS $4.00.

From American Society of Programmetry meeting; Washington, District of Columbia, USA (Sep 1974).

To compare various analysis techniques for photographic remotely sensed data as applied to land uses relevant to power plant site surveys, an aerial photographic survey of a proposed conventional power plant near Sterling, New York. The photographic records consist of false color I.R. (500 to 900 nm bandpass), regular color (400 to 690 nm bandpass), black and white visible (600 to 700 nm bandpass), and three filtered black and white I.R. records (600 to 900 nm, 750 to 900 nm, and 800 to 900 nm). The data were analyzed by several methods including trained photo interpreter, video level slicing, and spatial frequency analysis to determine relative land use discrimination of each analysis method. The classification test consists of correctly differentiating the number of uses in the scene, identifying the land use, and finally, determining the area and location of the land use. The classification test was further divided into three levels of increasing complexity. (auth)

32126 (ORNL-TM-4662) STORM RUNOFF IN THE VICINITY OF OAK RIDGE, TENNESSEE. Sheppard, J. D. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. Contract W-7405-eng-26. 29p. Dep. NTIS $4.50.

Meteorological data on the atmospheric precipitation measured at Oak Ridge, Tenn. during the period from 1948 to 1973 is analyzed to document some of the discharge relationships among the major streams in the Oak Ridge area with particular reference to peak storm flows. The flows in six specific streams in the area were studied. Seasonal variations in precipitation and flow patterns were examined. Peak discharges from particular streams as the result of unusually severe rainstorms, such as 9 in. of precipitation in 48 h, are predicted. (LCL)

32127 (WASH-1332(74)(Vol.1), pp 495-510) PLUTONIUM IN SOIL AT THE SAVANNAH RIVER PLANT. McClearen, H. A. (E. I. du Pont de Nemours and Co., Aiken, SC). Apr 1974. (DPSPU-74-30-14).

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

The amount of Pu in undisturbed soils reflects cumulative deposition from all sources. The program to measure Pu in soils was intensified at the Savannah River Plant (SRP) in 1972. Plant perimeter and off-site soil samples show a background deposition level of approximately 2 mCi/km^2. This is well within the range of deposition noted in southeastern United States and indicates that off-site deposits due to SRP operations are small compared to background. Samples taken within a 2-kilometer radius of each of the two chemical separations areas show higher levels, indicating some plant contribution. (auth)

32128 (WASH-1332(74)(Vol.2), pp 569-576) MOUND LABORATORY'S AIR SURVEILLANCE SYSTEM. Carfagno, D. G. (Monsanto Research Corp., Miamisburg, OH). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

A comprehensive air surveillance system was developed at Mound Laboratory. The system includes radiation monitoring of the source, transport conditions, and concentration at the receptor sites. An unusual aspect of the system is the implementation of off-site sampling programs through local governmental agencies. Background levels of radioactivity are also routinely determined. (auth)

32129 (WASH-1332(74)(Vol.2), pp 727-764) WHAT CAN BE LEARNED FROM THE CLEANUP OF THE TATUM DOME TEST SITE, HATTIESBURG, MISSISSIPPI? Church, B. W. (Atomic Energy Commission, Las Vegas, NV). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

A summary of the operations responsible for the radioactive contamination of the site of a contained underground nuclear explosion are reviewed. The effects of time and weathering on contamination spread; the significance of examining historical records and interviewing participating personnel; and the value of performing preliminary surveys and the impact of the preliminary survey actually conducted are discussed. The extent of the cleanup in terms of describing the sampling, documentation, and earth and material removal is presented. The impact of the cleanup organizational (management) structure is also assessed. It was concluded that the most important part of a nuclear site cleanup is the precleanup survey. Recommendations to enhance future cleanup of operational sites are presented. It is emphasized that sites and activity areas should not be allowed to remain in standby conditions for long time periods. Personnel change, conditions change, records are lost, and material of all types tend to become mobile. If operational sites and facilities are to remain idle for appreciable time periods, an interim cleanup should be completed to minimize effects of time. (CH)

Thermal Effluents

Refer also to abstracts 32019, 32037, 32038, 32092, 32190, 34301, 34327, 34462, and 34470.

32130 (AED-CONF-73-170-002) BIOLOGICAL-CHEMICAL PROBLEMS OF WASTE HEAT LOAD OF OUR SURFACE WATERS. Knoepp, H. (Bundesanstalt fuer Gewaesserkunde, Koblenz (F. R. Germany)). 1973. 17p. (In German). (CONF-7306101-1).

From meeting of the VDI, Fachgruppe Energietechnik; Duesseldorf, F. R. Germany (13 Jun 1973).

The following parameters for the effects of the thermal load of waters are discussed: the maximum temperatures in the settling tank; the heating span of the settling tank; the maximum temperature of the cooling water in once-through or closed-circuit cooling; change in the annual temperature variations; loss of water; type of water affected (fishing area, initial loading with organic and toxic materials); interference with the organic initial loading of the waters (effect on the oxygen household); and the requirements developed for cooling water pipes of nuclear power plants. (GE)

32131 (ANL-8060(Pt.3), pp 99-101) THERMAL EFFECTS RESEARCH ON LAKE MICHIGAN: INTRODUCTION. Spigarelli, S. A. 1973.

In Radiological and Environmental Research Division annual report, January-December 1973.

The majority of the power generation stations on the Great Lakes utilize once-through cooling systems. A research program is described whose objective is quantifying the ecological effects associated with once-through cooling on the Great Lakes, determining the magnitude of tolerable water use and associated effects, and developing regional plans whereby social, economic, and ecological factors are blended to provide environmentally acceptable power production techniques and levels. Emphasis was placed on studies on the behavior of fishes in Lake Michigan relative to waste heat discharge. (CH)

32132 (ANL-8060(Pt.3), pp 102-103) STUDIES OF FISH BODY TEMPERATURES. Spigarelli, S. A. 1973.

In Radiological and Environmental Research Division annual report, January-December 1973.

Limited measurements of fish body temperstures at the Point Beach Nuclear Plant during 1972 showed that, under most con-

ditions, fish were not equilibrated to maximum discharge temperatures, and often appeared to be exercising behavioral thermoregulation. These studies were expanded in 1973 to include approximately 1600 individual body temperature measurements made on fish collected from the flume and on fish caught by fishermen. These data will provide an excellent description of seasonal temperature selection and behavioral responses by the many species of fish found at Point Beach. (auth)

32133 (ANL-8060(Pt.3), pp 104-112) SEASONAL VARIATION IN SPECIES COMPOSITION AND ABUNDANCE OF FISH AT THE POINT BEACH NUCLEAR PLANT BETWEEN MARCH AND NOVEMBER 1973. Romberg, G. P.; Spigarelli, S. A. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

Marked seasonal changes in abundance and species composition of the many fish that are present near the thermal discharge to Lake Michigan from the Point Beach Nuclear Power Plant were found. Short-term differences occur due to lake conditions or water temperature, but definite seasonal patterns are apparent. For most fish, these seasonal patterns are directly related to their reproductive cycles. Annual differences may be a result of natural circumstances, but in many cases they are the direct result of changes in fish stocking programs. Results are reported from studies conducted at Point Beach Nuclear Plant from 1971 to 1973 that have provided both qualitative and quantitative data on the abundance and species composition of fish. These studies included monthly collection of fish during May to October 1971, creel censuses during August to November 1972 and April to November 1973, fish tagging studies during September to October 1972 and March to October 1973. (auth)

32134 (ANL-8060(Pt.3), pp 113-119) STUDIES OF FISH DISTRIBUTION IN THERMAL PLUMES AND FISH RESPONSES TO REACTOR SHUTDOWN. Spigarelli, S. A.; Romberg, G. P. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

Fish density and distribution in Lake Michigan thermal plumes are being investigated by a technique that simultaneously maps a thermal plume (horizontally and vertically) and fish distribution within the plume area. Preliminary studies have proved the efficacy and value of this technique in describing the temperature and spatial distribution of fish under varying discharge and lake conditions. Numerous fish locater surveys were conducted at the Point Beach Nuclear Plant during 1972 and 1973 to study: the relative differences in fish distribution between ambient shoreline areas (controls) and the area affected by the Point Beach thermal discharges, and changes in fish distribution resulting from reactor shutdown. Two scheduled reactor shutdowns were studied during 1972, and surveys were made during 1973 to characterize the seasonal changes in fish density and orientation to the thermal discharges. In each survey mapping runs were made in control areas and the plume area to compare fish density and distribution. (CH)

32135 (ANL-8060(Pt.3), pp 127-134) PLUME RESIDENCE OF TLD TAGGED FISH. Romberg, G. P.; Prepejchal, W. 1973.

In Radiological and Environmental Research Division annual report, Janauary–December 1973.

Temperature sensitive TLD tags show that brown trout, rainbow trout, and chinook salmon recaptured at Point Beach had spent little time at discharge temperatures. Maximum residence time for most fish was less than 50 hr, which represents less than 10% of the total time between release and recapture. The two longest residence times of 177 hr and 300 hr were for brown trout and represented 35% and 45% of the total exposure time for respective fish. The actual discharge residence times may be considerably shorter than the reported maximum residence times, due to conservative assumptions about when the fish were actually in the discharge water. Recapture locations and the estimated residence times for these fish indicate that, in general, brown trout have the greatest discharge preference, followed by chinook salmon and rainbow trout. (auth)

32136 (ANL-8060(Pt.3), pp 135-141) MOVEMENTS AND RECAPTURES OF FISH TAGGED AT THE POINT BEACH NUCLEAR PLANT DURING 1973. Spigarelli, S. A.; Thommes, M. M. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

The density and species composition of fish at the Point Beach Nuclear Plant thermal discharge to Lake Michigan fluctuate widely with season, primarily as a result of the migrations of anadromous (stream spawning) salmonids and alewives. Large numbers of these species are found in this area during their spawning seasons, presumably a response to current and/or elevated water temperatures. Much concern has been expressed over the effects of plume residence and abnormal temperature exposures on Lake Michigan fish. However, few in situ studies have attempted to quantify fish densities, residence times; or the migrational behavior of fish relative to thermal discharges. Obviously, these questions must be answered prior to a determination of physiological effects or additive effects resulting from numerous discharges on Lake Michigan. One approach to an assessment of fish exposure to thermal discharges is fish tagging at selected discharge sites. This procedure provides important information on the migrational tendencies of fishes and allows an estimate of the attractive influence of thermal discharges. Results are reported from studies on the movements of fish tagged at the Point Beach thermal discharge during 1973. The numbers and species of fish tagged were determined partially by availability and also by the choice of those species which are important in the local Lake Michigan fishery. (CH)

32137 (ANL-8060(Pt.3), pp 142-149) SPORT FISHING SURVEY AT THE POINT BEACH NUCLEAR PLANT DURING 1973. Spigarelli, S. A.; Thommes, M. M. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

A sport fishing survey was conducted at the Point Beach plant during a seven-month period (April 6 to November 3, 1973). The objectives were to describe the sport fishery at a typical shoreline thermal discharge to Lake Michigan; to compare the potential of thermal discharge fisheries with other Lake Michigan fisheries (e.g., boat and pier fisheries); and to gain valuable biological information regarding temporal changes in fish species composition, feeding habits, temperature preferences, and migrational tendencies of fish. (CH)

32138 (ANL-8060(Pt.3), pp 150-151) TRACKING OBSERVATIONS OF FISH IN A THERMAL DISCHARGE DURING NORMAL OPERATION AND SHUTDOWN. Thommes, M. M., Prepejchal, W. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

Considerable concern exists over the fate of fish acclimated to warm water discharges and exposed to sudden reductions in water temperature caused by shutdown. To investigate these conditions, Lake Michigan fish behavior was monitored during scheduled shutdowns of Units 1 and 2 of the Point Beach Nuclear Power Plant, Two Rivers, Wisconsin and preliminary results are reported. A simple method of observation was adopted to follow individual fish. Two-inch diameter plastic floats were attached to fish with 18 ft of nylon line through the epaxial muscle mass directly behind the dorsal fin. Floats were color-coded and numbered so that several fish could be continuously observed. (CH)

32139 (ANL-8060(Pt.3), pp 156-159) PRELIMINARY USE OF RNA-DNA RATIOS TO ESTIMATE RECENT GROWTH OF LAKE MICHIGAN FISHES. Spigarelli, S. A.; Harbach, P. R. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

Research in protein synthesis and growth of fishes has shown that RNA (ribonucleic acid) increases in fast-growing cells as a result of its function as a protein precursor and that DNA (deoxyribonucleic acid) concentration is constant in the various somatic cells of an organism. These investigations show that the concentration of RNA in relation to DNA (the RNA-DNA ratio) can be used as an indicator of recent growth in animals. This technique was used to demonstrate the effects of water temperature on the subsequent growth of fish in Lake Michigan. (CH)

32140 (CONF-730505-) THERMAL ECOLOGY. Proceedings of a Symposium Held at Augusta, Georgia, May 3–5, 1973. AEC Symposium Series. Gibbons, J. W.; Sharitz, R. R. (eds.). (Savannah River Ecology Lab., Aiken, S. C. (USA)). 1974. 687p. Dep. NTIS $13.60.

Fifty-five papers were presented at the symposium. Separate abstracts were prepared for 49 papers and the remaining six appeared previously in NSA as abstract numbers 28:8200; 28:8201; 28:12880; 28:15137; 28:17736; 28:21159. (HLW)

For abstracts of individual papers see: 31990, 32121, 32122, and 32141–32186.

32141 (CONF-730505-, pp 1-27) EVALUATION OF HEAT DISTRIBUTION IN A SOUTH CAROLINA RESERVOIR RECEIVING HEATED WATER. Lewis, W. M. Jr. (Savannah River Ecology Lab., Aiken, SC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Techniques for treating temperature data from thermally polluted lakes are proposed and applied to a South Carolina reservoir

receiving waste heat. Theoretical justification is provided for reducing temperature profiles to three biologically meaningful variables: the total heat per unit of surface area in excess of a specific base temperature, the mean temperature of the upper water column, and an index of thermal heterogeneity. An algorithm is provided for calculating these indexes from any vertical temperature profile. The distribution of waste heat in a reservoir is illustrated using the concepts of excess heat, mean epilimnetic temperature, and thermal heterogeneity. Heat enters the lake at about 31°C and is horizontally distributed with great efficiency near the discharge. Waste heat is largely confined to a surface layer even at the discharge site, where turbulence is great. A diurnal study in March showed that stabilization of the water column by waste heat persisted overnight despite some nocturnal cooling but was least marked at stations remote from the discharge. A study of heat distribution on consecutive days showed that total heat above the base line can be much lower near the discharge than at other points in the lake as a result of internal seiches and possibly of variation in wind exposure. Thermal heterogeneity, however, was always highest near the discharge. An extended study of heat distribution during late winter and early spring demonstrated the effects of natural solar warming, gale winds, interruption of heat flow, and other factors. Extraordinary hypolimnetic warming of the lake occurs during early spring and is attributed to the addition of waste heat. The relevance of these findings to reservoirs at other latitudes is discussed. (auth)

32142 (CONF-730505-, pp 43-53) EFFECTS OF ACUTE EXPOSURE TO SUBLETHAL CONCENTRATIONS OF CADMIUM ON THE THERMAL RESISTANCE OF THE MUMMICHOG. McKenney, C. L. Jr.; Dean, J. M. (Univ. of South Carolina, Columbia). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Acute exposures to sublethal concentrations of cadmium reduced the thermal resistance of the mummichog, Fundulus heteroclitus, under several conditions of acclimation, test temperature, and cadmium concentration. At all test temperatures fish acclimated at 10, 20, and 30°C and exposed to 56 mg Cd^{2+}/liter for 24 hr (40% LD_{50} at 20°C) had thermal-resistance times significantly lower than those of control fish. Exposure to 28 and 14 mg Cd^{2+}/liter for 24 hr (20% and 10% LD_{50}, respectively, at 20°C) affected thermal resistance of the fish as a function of acclimation temperature. A more striking reduction in thermal resistance was observed in those fish exposed to 28 mg Cd^{2+}/liter for 24 hr and acclimated at 10°C than those fish exposed to the same concentration of cadmium and acclimated at 30°C. Exposure to 14 mg Cd^{2+}/liter for 24 hr had no effect on the thermal resistance of fish acclimated at 30°C and reduced the median resistance times of fish acclimated at 10°C to a greater extent than it did those of the fish acclimated at 20°C. (auth)

32143 (CONF-730505-, pp 54-58) COMBINED EFFECTS OF MERCURY AND TEMPERATURE ON THE MORTALITY OF RAINBOW TROUT. Thatcher, T. O. (Pacific Northwest Lab., Richland, WA). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Fourteen continuous flow-through 96-hr TL_{50} bioassays were conducted to observe the combined effects of temperature alteration and mercury on the mortality of juvenile rainbow trout. A two- to threefold difference in resistance was recorded. Fish exposed at 15°C were more resistant to mercury than those exposed at 10 or 20°C after all fish had been acclimated to 10°C. (auth)

32144 (CONF-730505-, pp 59-78) SATURATION VALUES OF DISSOLVED GASES ASSOCIATED WITH THE OCCURRENCE OF GAS-BUBBLE DISEASE IN FISH IN A HEATED EFFLUENT. Adair, W. D.; Hains, J. J. (Duke Power Co., Charlotte, NC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Gas-bubble disease in fish inhabiting a cove that received the heated effluent from a steam electric station was investigated. During the winter of 1971–1972, the concentrations and the corresponding dissolved-oxygen and -nitrogen saturation values associated with the heated effluents from three Duke Power Company steam stations were determined. The N_2 supersaturation in the discharge area at Marshall Steam Station was generally equal to or higher than that obtained in the discharge areas of two other steam stations. At Marshall the N_2 supersaturation was highest at the point of discharge, but it returned to near control or below 110% levels at a station 3.0 km downstream; O_2 was supersaturated at the point of discharge only from January to March. The withdrawal of intake water under a skimmer wall did not result in higher than control saturation values at the plant intake structure. (auth)

32145 (CONF-730505-, pp 79-93) INCIDENCE AND CAUSE OF GAS-BUBBLE DISEASE IN A HEATED EFFLUENT. Miller, R. W. (North Carolina Wildlife Resources Commission, Raleigh). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Fish sampling conducted in the heated effluent from Marshall Steam Station on Lake Norman, N. C., during the winter and spring of 1971–1972 revealed nine species of fishes with external symptoms of gas-bubble disease. Popeye of one or both eyes and gas bubbles in the fins were the most commonly observed symptoms. The percent incidence of the disease was highest for redhorse suckers (28.6%), white bass (27.8%), white crappies (20.0%), and redbreast sunfish (13.0%). Disease incidence for all fishes captured peaked at 4.7% in February. Water samples taken from the discharge area during the periods of fish sampling confirmed the suspicion that gas supersaturation was causing the disease since the discharge-water samples were supersaturated with nitrogen from November 1971 through May 1972. Sampling in the discharges of two other steam electric stations on nearby reservoirs revealed a low incidence of gas-bubble disease, i.e., 0.2% of the total combined catches. (auth)

32146 (CONF-730505-, pp 100-108) EFFECTS OF THERMAL EFFLUENT ON THE FAT CONTENT OF THE MOSQUITO FISH. Falke, J. D.; Smith, M. H. (Savannah River Ecology Laboratory, Aiken, SC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Mosquito fish were collected at the Savannah River Plant from seven locations, three areas receiving thermal effluent, one thermal recovery area, and three natural areas. Percentage of fat in each fish was determined and was correlated with the log of the dry weight, but not with standard length. Females had significantly more fat than males at all locations except one. Significant differences in fat content were attributable to location, but no correlation was found between percentage of fat and habitat temperature. Several hypotheses may help to explain the data, but it seems likely that Gambusia affinis is naturally a eurythermal species. Southern populations of the species should be useful in stocking programs that are part of reactor construction plans. (auth)

32147 (CONF-730505-, pp 119-132) BODY-TEMPERATURE CHARACTERISTICS OF FISH AT A THERMAL DISCHARGE ON LAKE MICHIGAN. Spigarelli, S. A.; Romberg, G. P.; Prepejchal, W.; Thommes, M. M. (Argonne National Lab., IL). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

The body-temperature changes of 70 Lake Michigan fish (five species) experimentally exposed to elevated or reduced temperatures were continuously monitored to determine internal-body-temperature change rates and equilibration tendencies. The heat-exchange half-times (t_h) of fish exposed to temperature changes of 4 to 9°C differed greatly between species and were generally proportional to body weight. The internal temperature of small trout, chubs, and alewives (<100 g) changed rapidly, requiring less than 10 min total stabilization time. Conversely, large carp (~4000 g) required on the order of 1 to 2.5 hr total time. Alewives exposed to both elevated and reduced temperatures required a longer time for cooling than for warming. Derived heat-exchange half-times are used to calculate the short-term residence times of fish collected from warm discharge waters. In both elevated- and reduced-temperature experiments, the final body temperature of alewives, brown trout, and carp stabilized at a higher temperature than that of the exposure medium (0.02 to 0.31°C), implying a limited capacity for heat conservation. Body-temperature measurements made on 274 fish (six species) collected from the discharge area reflect substantial behavioral thermoregulation. Fish collected from warmed inshore waters and near-field plume areas generally had body temperatures that approximated the water temperature at the point of collection (±1.5°C). The body temperatures of trout caught by fishermen from the discharge outfall were lower than the discharge temperature and approximated the final preferred temperatures of each species. The majority of fish collected from the discharge flume had temperatures lower than that of the discharge water, implying recent entry or regulation by movement between cool and warm areas. (auth)

32148 (CONF-730505-, pp 133-145) EFFECT OF THERMAL STRESS ON DRAGONFLY NYMPHS. Martin, W. J. (Birmingham-Southern Coll., AL); Gentry, J. B. 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Dragonfly nymphs of the genus Libellula were collected from a thermally stressed stream and a natural (control) stream and tested for critical thermal maximum (CTM) and lethal temperature (LT) after acclimation for more than 24 hr at 15, 20, 25, 30, and 35°C. In winter the water temperatures at the collection sites ranged from 30 to 33°C in the thermal stream and 5 to 12°C in the natural stream. Correlations were observed between CTM, LT, and body length at the different acclimation temperatures. The LT at 15°C for nymphs from the thermal stream was 43.8°C; it increased at a constant rate to 47.7°C at 30°C, but there was no significant increase at 35°C. For nymphs from the control stream, the LT at 15°C was 42.8°C; it declined to 42.1°C at 25°C and then increased rapidly to 45.5°C at 35°C. Nymphs collected from the thermal-effluent stream were larger than those from the natural stream. Nymphs react to thermal stress through both short-term physiological adjustments and long-term evolutionary responses at the population level. (auth)

32149 (CONF-730505-, pp 151-157) CHRONIC MALNUTRITION IN FOUR SPECIES OF SUNFISH IN A THERMALLY LOADED IMPOUNDMENT. Graham, T. P. (Univ. of North Carolina, Asheville, NC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Chronic malnutrition was discovered in four species of sunfish (Lepomis) present in a small cooling impoundment. This malnutrition is related to high summer pelagic water temperatures resulting from the input of thermal effluent from a steam electric plant. Malnutrition seems to be brought about by a combination of increased metabolic demand on the Lepomis and upper limiting temperatures acting on their food organisms. (auth)

32150 (CONF-730505-, pp 158-163) EFFECTS OF THREE HEATING RATES ON THE CRITICAL THERMAL MAXIMUM OF BLUEGILL. Cox, D. K. (Oak Ridge National Lab., TN). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Bluegill acclimated to 26°C for a minimum of 14 days were subjected to temperature-elevation rates of 0.1, 0.5, and 1.0°C/min. Temperatures at which loss of equilibrium and cessation of opercular beating occurred were determined. The slower rates of heating produced lower mean end-point temperatures. Large bluegill were more sensitive than small ones to heat stress in terms of loss of equilibrium but had greater stamina in resisting physiological death (cessation of opercular beating). Higher mean end-point temperatures were achieved at the faster rates of heating because the dying rate did not keep pace with the rapid heating of the external media. (auth)

32151 (CONF-730505-, pp 164-170) HATCHING SUCCESS OF BLUEBACK-HERRING AND STRIPED-BASS EGGS WITH VARIOUS TIME VS. TEMPERATURE HISTORIES. Schubel, J. R.; Auld, A. H. (Johns Hopkins Univ., Baltimore). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Blueback-herring (Alosa aestivalis) eggs in the 4- and 8-cell stages and in the late-embryo tail-free stage and striped-bass (Morone saxatilis) eggs in the late-gastrula stage were exposed to time vs. excess-temperature conditions typically experienced by organisms entrained by Chesapeake Bay power plants. The period of exposure to a maximum ΔT of 5.5 to 7.0°C ranged from 5 to 70 min, and the period for cooling back to the intake temperature, i.e., the average water temperature in the spawning grounds, ranged from 30 min to nearly 6 hr. The experimental samples of herring eggs had absolute hatching successes 10 to 14% lower than those of the controls. The experimental samples of striped-bass eggs had absolute hatching successes 2 to 8% lower than those for the controls. For both species the decreases were statistically significant, but it is unlikely that they would be biologically significant. (auth)

32152 (CONF-730505-, pp 171-176) RELATIVE SENSITIVITY OF DIFFERENT DEVELOPMENTAL STAGES OF CARP EGGS TO THERMAL SHOCK. Frank, M. L. (Oak Ridge National Lab., TN). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

The effects of an acute thermal shock on the development of carp (Cyprinus carpio L.) eggs were investigated by subjecting groups of eggs to a 10-min thermal shock at different stages of development and comparing their subsequent development with that of controls. Exposure temperatures were 25 (controls), 35, 37.5, 40, 42.5, and 45°C. Eggs exposed to 42.5 and 45°C did not develop. The response of eggs exposed to 35, 37.5, and 40°C depended on their stage of development at the time of the shock. The eggs were more susceptible to thermal damage during the cleavage and blastopore-closing stages than at any other time. (auth)

32153 (CONF-730505-, pp 186-206) RESPONSES OF PLANKTONIC CLADOCERANS TO HEATED WATERS. Carlson, D. M. (Cornell Univ., Ithaca, NY). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Thermal discharges to lakes and streams are environmental stresses of growing importance, yet little is known about their effect on populations of zooplankton. Studies at Cornell University, Ithaca, N. Y., on zooplankton communities reared under thermal stress directed attention to a cladoceran species, Scapholeberis kingi. Zooplankton community dynamics were followed for 35 days. Mortality and development rates for S. kingi were estimated at the different temperature treatments, and the median tolerance limit (TL_m) for temperature was estimated with bioassays. Comparable bioassays were conducted on a S. kingi population in a warmer climate to evaluate geographical variation in thermal tolerance. Bioassays on a population from a thermally stressed pond on the Savannah River Plant, Aiken, S. C., showed there was no difference in the TL_m (37°C) between the South Carolina and New York populations at 12 and 24 hr. The South Carolina population contained a few individuals with unusually high resistance to lethal temperatures. (auth)

32154 (CONF-730505-, pp 207-215) EFFECTS OF THERMAL EFFLUENT ON THE POPULATION DYNAMICS OF HELMINTH PARASITES IN LARGEMOUTH BASS. Eure, H. E. (Savannah River Ecology Lab., Aiken, SC); Esch, G. W. 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Samples of largemouth bass (micropterus salmoides) were taken from June 1972 through March 1973 at six locations in Par Pond on the Savannah River Plant site near Aiken, S. C. The pond has temperature regimes ranging from normal to >10°C above normal. Helminth parasites in largemouth bass exhibited a definite seasonal change in intensity of infection but not in incidence of infection. The pattern was most apparent for the acanthocephalan Neoechinorhynchus cylindratus. This same pattern held for the tapeworm, nematode, and trematode populations, although the levels of infection were lower than those of the acanthocephalan populations. Fish from all areas had relatively reduced parasite loads from June through October. Maximum worm burdens were reached in December and were maintained through March. The number of parasites per host was significantly higher in fish taken from areas with elevated water temperature compared to those from normal areas. Female hosts had higher worm burdens than males. Sex ratios for N. cylindratus were not significantly different in fish taken from areas of Par Pond having different temperature regimes. (auth)

32155 (CONF-730505-, pp 216-222) THERMAL REGIME ALTERATION AND VITAL ENVIRONMENTAL PHYSIOLOGICAL SIGNALS IN AQUATIC ORGANISMS. Lehmkuhl, D. M. (Univ. of Saskatchewan, Saskatoon). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

In temperate climates, characterized by distinct warm and cold seasons, many aquatic insects are dependent on key temperatures to initiate embryological development, signal eclosion from the egg, control the rate of growth, and stimulate emergence of adults. Deep reservoirs with hypolimnion drains cause a type of thermal pollution by releasing a summer cool but winter warm outflow. No lethal temperatures are involved, but the lack of or the abnormal timing of signals as a result of the reservoir exterminated most of the intermediate members of a food chain up to 70 miles downstream of a reservoir. The principle of the altered thermal regime would apply to any source of unseasonably warm or cool water. Meaningful life-cycle and reproductive data are scarce in the published literature, but the validity of the principle can be illustrated with the examples from the Ephemeroptera. (auth)

32156 (CONF-730505-, pp 223-236) EFFECTS OF A THERMAL EFFLUENT ON THE AMERICAN OYSTER. Tinsman, J. C.; Maurer, D. L. (Univ. of Delaware, Lewes). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Oysters, Crassostrea virginica (Gmelin), were placed in three locations in Indian River Bay, Del.: at the intake canal of the Delmarva Power and Light Co. fossil-fuel power plant, 2.5 km downstream at the mouth of the effluent canal, and 6 km downstream from the plant. The thermal effluent shortened and reduced the severity of the winter and increased the growing season of these organisms. Oysters placed in the effluent showed the greatest shell growth, the highest meat weights and glycogen concentrations, and the lowest mortalities throughout the winter. However, summer conditions in the effluent caused lower meat weights and glycogen concentrations and higher mortalities than at other stations. The study shows both beneficial and detrimental effects of exposure to thermal effluents. (auth)

32157 (CONF-730505-, pp 237-245) EFFECTS OF THERMAL EFFLUENTS ON POPULATIONS OF MOSQUITO FISH. Ferens, M. C.; Murphy, T. M. Jr. (Savannah River Ecology Lab., Aiken, SC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Reproduction, sex ratios, and size structure were examined in populations of the mosquito fish Gambusia affinis from lentic and lotic environments with different thermal conditions. Winter temperatures at the time of sampling ranged from 16.5°C in a pond receiving no thermal effluent to 44°C in a heated pond. Sex ratios varied greatly among locations with no apparent relation to temperature or habitat. No females from nonheated areas were carrying eyed embryos. The percentage of females 30 mm or more in length bearing eyed embryos increased linearly with water temperature. Size structure was also altered as indicated by the curvilinear decrease in the ratio of median to maximum length with increasing water temperature. Secondary productivity was higher in heated environments. (auth)

32158 (CONF-730505-, pp 246-254) GROWTH AND CONDITION OF JUVENILE LARGEMOUTH BASS FROM A RESERVOIR RECEIVING THERMAL EFFLUENT. Bennett, D. H.; Gibbons, J. W. (Savannah River Ecology Lab., Aiken, SC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Growth and condition of juvenile largemouth bass (Micropterus salmoides) were studied in an 1120-ha reservoir near Aiken, S. C. The reservoir receives thermal effluent from a nuclear reactor. Mean surface-water temperatures in a cove receiving thermal effluent exceeded temperatures in nonheated areas by 7 and 3°C for 1969 and 1970, respectively. Juvenile bass collected during their first summer from the heated station were generally larger and grew significantly faster than young bass from nonheated waters. The condition factors of all juvenile bass collected were generally similar. Results from this study indicate that early growth and body condition of juvenile largemouth bass may not be impaired by thermal effluent. (auth)

32159 (CONF-730505-, pp 255-263) BIOCHEMICAL GENETICS OF SUNFISH. III. Genetic Subdivision of Fish Populations Inhabiting Heated Waters. Yardley, D.; Avise, J. C.; Gibbons, J. W.; Smith, M. H. (Savannah River Ecology Lab., Aiken, SC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Electrophoretic techniques were used to examine allele frequencies at polymorphic genetic loci in populations of largemouth bass (Micropterus salmoides), mosquito fish (Gambusia affinis), and bluegill (Lepomis macrochirus) for evidence of genetic changes associated with their inhabiting waters receiving thermal effluent from nuclear reactors. Comparisons were made between populations inhabiting natural bodies and those living in waters receiving thermal effluent. There were no clear effects of thermal effluent on allele or genotype frequency at any of the observed loci. However, there is significant regional genetic heterogeneity, and two species showed significant differences in allele frequencies between lentic and lotic environments. (auth)

32160 (CONF-730505-, pp 264-276) GROWTH AND DEVELOPMENTAL RESPONSES OF LARVAL TOAD POPULATIONS TO HEATED EFFLUENT IN A SOUTH CAROLINA RESERVOIR. Nelson, D. H. (Michigan State Univ., East Lansing). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Eggs of the Southern toad (Bufo terrestris Bonnaterre) were laid in a reservoir receiving heated effluent from a production reactor on the Savannah River Plant area. Larvae were removed at weekly intervals from different thermal regimes in and around the reservoir for comparison of rates of development and growth. Larvae were measured and staged according to the level of development. Embryonic and larval mortality, which were high in an unprotected area along the reservoir shoreline, were negligible in shallows receiving cool-stream seepage. Different growth and developmental rates reflected the extent of thermal loading imposed on the habitat. Within the range of thermal tolerance, embryos living in habitats influenced by the thermal effluent developed more rapidly and metamorphosed at a smaller size than those living in unheated areas. (auth)

32161 (CONF-730505-, pp 277-284) ENHANCED GROWTH AND INCREASED BODY SIZE OF TURTLES LIVING IN THERMAL AND POST-THERMAL AQUATIC SYSTEMS. Christy, E. J.; Farlow, J. O.; Bourque, J. E.; Gibbons, J. W. (Savannah River Ecology Lab., Aiken, SC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Population size structure and individual growth rates of the yellow-bellied turtle (Pseudemys scripta) were examined from four distinct types of habitat: areas that receive no thermal loading and therefore have normal water temperatures; aquatic areas receiving heated effluents; post-thermal recovery habitats that once received intense thermal loading but no longer do so; and a chemically polluted pond. Both the nutrient balance and the community structure have been drastically altered from the natural state in these thermally and chemically altered environments. Adult turtles from the thermal and post-thermal areas attained significantly larger body sizes than those from natural habitats. In addition, individual turtles from the thermally and chemically influenced habitats grew faster than those in the natural areas. Changes in growth rates and body sizes resulted from direct and/or indirect thermal and chemical alterations; post-thermal environments continued to reflect such changes for as much as 9 years after the last thermal input. (auth)

32162 (CONF-730505-, pp 285-290) VERTICAL MOVEMENT OF ZOOPLANKTON IN RESPONSE TO HEATED WATER. Gehrs, C. W. (Oak Ridge National Lab., TN). 1974.

From thermal ecology symposium; Augusta, Georgia USA (3 May 1973).

In thermal ecology.

The vertical locomotory response of individuals of Diaptomus sanguineus and Daphnia parvula to heated water was tested. All animals moved deeper when the temperature of the water at the level in which they resided was increased 2°C. These results, as well as data in the literature, suggest that the vertical movement of zooplankton can be inhibited either by a large temperature gradient over a small vertical range (as in a thermocline) or by a temperature above the preferred temperature of individuals of a particular zooplankton population. Surface waters heated by thermal effluents from power plants can restrict the movement of zooplankters, which could result in decreased productivity. (auth)

32163 (CONF-730505-, pp 291-295) PLANKTON ENTRAINMENT BY THE CONDENSER SYSTEMS OF NUCLEAR POWER STATIONS ON LAKE ONTARIO. Storr, J. F. (State Univ. of New York, Buffalo). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Entrainment studies on plankton were carried out over a 2-year period at two nuclear power stations on Lake Ontario. Counts of plankton organisms from both the intake and the discharge were compared using motility of the plankters as an indication of a living condition. Plankton were also held and compared after temperature equilibration of the two samples and at the end of a 24-hr period. The mean mortality of the plankton at the two stations was 18.3 and 25.5%, with no significant difference between them although operational temperature rises varied by approximately 7°C between the two stations. Latent mortality was not significant at either station after 24 hr. Mechanical stress is assumed to play an important part in total mortality. When subjected to heating under experimental conditions similar to conditions in the condenser, plankton show very low (5% or less) mortality for temperatures under 35°C. Above 35°C lethality increases rapidly to 100% at 40.5°C. (auth)

32164 (CONF-730505-, pp 296-312) FISH BEHAVIOR AT A THERMAL DISCHARGE INTO LAKE MICHIGAN. Romberg, G. P.; Spigarelli, S. A.; Prepejchal, W.; Thommes, M. M. (Argonne National Lab., IL). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

There are marked seasonal changes in abundance and species composition of the many fish that are attracted to the shoreline

thermal discharge from the Point Beach Nuclear Power Plant (located near Two Creeks, Wis.). Smelt and alewife represent the largest numbers of fish and occur in massive schools during April and May and from May to August, respectively. Large trout are present in the discharge in the winter, but the greatest concentrations seem to be in the spring and fall during spawning times. Hundreds of fish have been observed to move as close as possible to the upper end of the discharge flume. Fall tagging studies, however, indicated that the majority of trout that congregate near the power plant do not remain for extended periods and that there is a continual influx of new fish. Increases in the discharge temperature above 21°C and periodic decreases due to upwelling caused short-term changes in the dominant fish populations and often resulted in abrupt changes in sports fishing success. Trout species were caught primarily at discharge temperatures below 21°C, and nontrout species, at warmer temperatures. However, the species composition of the sports catch was not strictly related to either discharge or intake temperature. Body-temperature measurements made on trout caught by fishermen suggest that actively feeding fish were regulating their body temperatures near the final preferred temperature. Fish-locator studies suggest that no marked concentration of fish occurs within the far-field region of the warm plume. (auth)

32165 (CONF-730505-, pp 313-321) DISTRIBUTION OF ALLIGATORS IN RESPONSE TO THERMAL GRADIENTS IN A REACTOR COOLING RESERVOIR. Murphy, T. M. Jr.; Brisbin, I. L. Jr. (Savannah River Ecology Lab., Aiken, SC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Seasonal changes in the distribution of American alligators inhabiting heated and unheated portions of a large reactor cooling reservoir were studied. Abundance indexes, calculated from 4 years of daylight head counts conducted three times a month, were combined with 1 year of weekly night-cruise counts of alligators along the entire reservoir periphery. In winter alligators congregated and remained active in the area of the heated effluent, but, in the remainder of the reservoir, they entered a semidormant state. Maximum abundance indexes in the unheated areas occurred during the summer months, but the numbers in the heated area were at a low. Water temperature predicts the alligator abundance index better than air temperature or photoperiod. Decreasing water temperatures in the fall appeared to stimulate the movement of animals throughout the reservoir. Animals that encountered warmer waters apparently restricted their movements to these heated areas. (auth)

32166 (CONF-730505-, pp 322-334) BEHAVIORAL THERMOREGULATION OF THE AMERICAN ALLIGATOR. Spotila, J. R. (State Univ. Coll., Buffalo). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Body temperatures of two alligators were recorded under seminatural conditions in St. Louis, Missouri, using thermistor thermometers and radiotelemetry. Accurate measurement of microclimatic variables (radiation, temperatures, wind speed, and relative humidity) provided a basis for assessing the role of behavior in the thermoregulation of this reptile. One alligator when tethered on land was unable to maintain its body temperature at a tolerable level. When the animal was allowed to enter water, its body temperature dropped and began to approach ambient. A second alligator with free access to a pool of water was able to regulate its body temperature within a narrow range suitable for activity. By basking on land this alligator quickly raised its body temperature above ambient. By using water as a heat sink, it stabilized body temperature and prevented overheating. When conditions on land exceeded the limits of its climate space, this alligator remained partially submerged with its back exposed to the sun, thus operating between the blackbody and full-sun lines of its climate space. Additional observations suggest that an alligator can regulate head temperature at a level above that of body temperature by keeping its head exposed to the sun. Radiotelemetry proved to be an effective means of studying the body temperature of a large reptile. Relatively simple and inexpensive to build, with a long range, the temperature transmitter described here can be used in field studies on other large animals. (auth)

32167 (CONF-730505-, pp 335-349) EFFECTS OF ABNORMAL TEMPERATURES ON ALGAL COMMUNITIES. Patrick, R. (Academy of Natural Sciences of Philadelphia). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

A review of the literature indicates that moderate increases in temperature toward the optimum range for the growth of species increases algal growth. Diversity and biomass may be increased by small temperature increases from the lower end of the tolerance range toward the optimum temperatures for association of species. Temperature shifts toward the upper limits of the tolerance range and beyond bring about a shift in species composition usually from diatom-dominated communities to those dominated by blue-green algae. These effects were noted in various field studies below the warm water discharges of power plants. Shock exposure to high temperatures can have deleterious effects on algae if the temperature rise is great or the exposure is extended for several hours. If accompanied by other stresses, even moderate temperature increases may have severe effects, often resulting in death. In estuaries where the percentage of water entrained is relatively small compared to the total volume of water, the effects on the phytoplankton may appear to be negligible in the receiving body of water. This may be due to the patchiness of phytoplankton distribution, the mixing of the discharge water with the receiving waters, and ecological variables that make statistically reliable results difficult to obtain. Experimental studies on entrainment indicate that heat shock for extremely small periods of time may have only temporary adverse effects on many species of algae. (auth)

32168 (CONF-730505-, pp 350-355) THERMAL EFFECTS ON THE MICROBIOLOGY AND CHEMISTRY OF THE CONNECTICUT RIVER: A SUMMARY. Rankin, J. S.; Buck, J. D.; Foerster, J. W. (Univ. of Connecticut, Noank). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

The effects of thermal effluent from a nuclear-powered electricity generating station were studied continuously in a section of the Connecticut River for 27 months before and 21 months after the start of operations. Physicochemical determinations included pH, temperature, salinity, dissolved oxygen, nitrate-, ammonia-, and organic-nitrogen, and total and orthophosphate. Microbiological studies considered quantitative and qualitative analyses of phytoplankton populations and various groups of bacteria: mesophiles, psychrophiles, thermophiles, anaerobes, total and fecal coliforms, enterococci, and proteolytic, lipolytic, amylolytic, and marine types. No direct effect of thermal effluent was observed on any of the chemical parameters. Although some shifts in bacterial genera were noted at the outfall station when compared with other areas, no detriment to the river ecosystem could be attributed to these changes. A shift in dominance from diatoms to blue-green and green microalgae in the mixing zone between warmed and ambient river water also occurred. (auth)

32169 (CONF-730505-, pp 356-362) IMPACT OF PRODUCTION-REACTOR EFFLUENTS ON VEGETATION IN A SOUTHEASTERN SWAMP FOREST. Sharitz, R. R. (Savannah River Ecology Lab., Aiken, SC); Gibbons, J. W.; Gause, S. C. 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Thermal discharges released from production reactors into tributary streams of the hardwood and cypress–gum swamp on the Savannah River Plant site have completely or partially destroyed the forest canopy and altered the floristic composition of two-thirds of the swamp. Categories of reactor-effluent impact were defined on the basis of the percentage of tree kill, and the areal extent of each category was determined. Detrimental effects were observed not only in areas receiving water at high temperatures but also in areas of ambient water temperature with abnormal flooding and heavy siltation. This study shows conclusively that such environmental effects must be considered in the future placement of power reactors. (auth)

32170 (CONF-730505-, pp 363-370) RESPONSE OF PERCH AND THEIR FORAGE TO THERMAL DISCHARGES IN LAKE ONTARIO. Storr, J. F.; Schlenker, G. (State Univ. of New York, Buffalo). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Varying distributional patterns of white perch (Roccus americanus), yellow perch (Perca flavescens), and other organisms in the area of two thermal discharges in Lake Ontario are discussed. An upwelling discharge forms a barrier that modifies wave activity and provides a quiet zone attractive to fish. Flow of the discharge plume was also attractive. Thermal release attracts directly by causing an increase in the basic food supply for fish in the area (i.e., in the numbers of Gammarus sp. present) and indirectly by raising temperatures. Fewer yellow perch were found in the area of warmest thermal impact in midsummer as contrasted to the control area. When cooler bottom water was drawn into the intake and then discharged, fish avoided the cooler

area to some degree in midsummer. The attraction of the fish to the discharge areas was not long term and, as shown by a fish-tagging program, did not prevent the normal fall migration away from the lakeshore. (auth)

32171 (CONF-730505-, pp 371-390) MANGROVE-ROOT COMMUNITIES IN A THERMALLY ALTERED AREA IN GUAYANILLA BAY, PUERTO RICO. Kolehmainen, S.; Morgan, T.; Castro, R. (Puerto Rico Nuclear Center, Mayaguez). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

The species composition and biomass of sessile and free-living organisms on the aerial roots of red mangroves were studied in a thermally loaded bay on the south coast of Puerto Rico. The number of species varied from 15 to 96 at different stations with water temperatures ranging from 31 to 40°C in summer. In winter less tolerant species, which were not found in summer in the warmest areas at 35 to 40°C, migrated to the warmest stations where the temperature varied between 33 and 35°C. The most resistant species were blue-green algae, barnacles (Balanus spp)., a polychaete (Pomatostegus stellatus), a sponge (Halisarca sp.), crabs (Aratus pisonii and Pachygrapsus transversus), a tree oyster (Isognomon alatus), a mussel (Brachidontes exustus), and a bryozoan (Crisia sp.), all found in temperatures above 37°C. The macroalgae, coelenterates, echinoderms, and ascidians were the least temperature tolerant groups. Mangrove-root communities were much more sensitive to the elevated temperatures than were mangrove trees. The biomass of organisms living on mangrove roots was largest at the stations with a yearly Δt ranging from +6 to +9°C, but the species were mainly tree oysters and barnacles. Both the species composition and biomass in the mangrove-root community were vertically zoned. The maximum values were found just below the intertidal zone. (auth)

32172 (CONF-730505-, pp 414-422) WINTER FAUNA IN A THERMAL DISCHARGE WITH OBSERVATIONS ON A MACROBENTHOS SAMPLER. Dahlberg, M. D.; Conyers, J. C. (Virginia Inst. for Scientific Research, Richmond). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

The influence of a thermal discharge on the fauna in the James River, Virginia, and the effectiveness of a benthic sampling device for monitoring freshwater macroinvertebrates were examined. The benthos sampler was constructed of a barbecue basket containing cinder-block chips and conservation cloth. Samplers were suspended in the water for 26 days during the winter and accumulated a greater variety and abundance of benthic organisms than were found in bottom samples at the same stations. Numbers of species and abundance of benthic macroinvertebrates increased as average temperature increased regardless of the diurnal variation in discharge temperature resulting from the swing-load plant operations. The high production of benthic organisms could partially account for the aggregation of fish in the plume. Seventeen species of fish were more abundant in the plume than at ambient-temperature stations. (auth)

32173 (CONF-730505-, pp 423-437) HEAT INFLUENCES IN ESTUARINE ECOSYSTEMS. Copeland, B. J.; Laney, R. W.; Pendleton, E. C. (North Carolina State Univ., Raleigh). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Studies were conducted in outdoor, artificial, and controlled estuaries and under controlled laboratory conditions to determine the response of ecosystems and individual organisms to heat loading. Temperature in the experimental artificial estuaries was maintained 5°C (9°F) above ambient (controls) during all seasons. Thermal treatment increased nutrient regeneration rates, yielding slightly higher algal biomass and photosynthesis/respiration ratios. Biomass of nekton and benthos was higher in the heated estuaries during spring but lower during summer (no significant differences during winter). The relationship of temperature to growth, food conversion, and assimilation efficiency was investigated for the croaker (Micropogon undulatus) in the laboratory. Growth and feeding efficiency were directly related to increases in temperature. The critical thermal maximum (CTM) of penaeid shrimp was significantly related to acclimation temperature, with lesser effects associated with salinity, size, and species. Similar responses were determined for the croaker, except acclimation temperature was more of a dominating factor. (auth)

32174 (CONF-730505-, pp 438-447) EFFECTS OF THERMAL EFFLUENTS ON FISH AND INVERTEBRATES. Benda, R. S. (Aquinas Coll., Grand Rapids); Proffitt, M. A. 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Two years of study on the effects in the White River at Petersburg, Ind., of a thermal effluent from an Indianapolis Power and Light Company plant are summarized. A single 220-MW unit operated in 1969 caused an average temperature elevation of less than 1°F (0.3°C). A second unit of 420 MW put into operation in 1970 caused an average temperature elevation of 3°F (1°C). With both units operating, the plant's normal output is about 640 MW. The ΔT between the intake and the discharge is 20°F (6.6°C) and the cooling water flow rate is about 675 ft^3/sec. The White River is a turbid stream about 450 ft in width at Petersburg. Its rate of flow varies from less than 1000 ft^3/sec to 100,000 ft^3/sec with an average flow of 2500 ft^3/sec. Studies revealed that heated water does not affect growth in length of longear sunfish (Lepomis megalotis), spotted bass (Micropterus punctulatus), bluegill (Lepomis macrochirus), and white crappie (Pomoxis annularis). The centrarchids in the heated sections were fewer in number per hectare and had a higher average condition factor than those in the unheated section. Fish were attracted to the heated discharge in cold months but were repelled during hot months as temperature tolerance levels were reached for each species. Although the thermal effluent traveled across the river, it did not create a barrier to migrating fish. Heated water depressed the populations of caddisfly larvae, mayfly nymphs, and other invertebrates in the discharge area when temperatures ranged from 88°F (31°C) to 103°F (39.4°C) but they recovered less than 1800 ft below the discharge. Chironomids, especially Glyptotendipes lobiferus, were the most frequently collected invertebrates in the heated section; they were not numerous in the unheated section. The overall effect of the heated water was to either increase or decrease invertebrate groups up to 1300 ft downstream from the discharge, affecting about 10 acres of river. Recovery was rapid in the downstream areas. (auth)

32175 (CONF-730505-, pp 462-474) RESPIRATION AND NET PRODUCTIVITY OF THE PLANKTON COMMUNITY IN A REACTOR COOLING RESERVOIR. Tilly, L. J. (E. I. du Pont de Nemours and Co., Inc., Aiken, SC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Monthly measurements comparing the respiration and primary productivity of plankton taken from cool and warm stations of a reactor cooling reservoir were made in 1970–1971. Respiration averaged about 20% more annually at the warm station, the difference being most pronounced in the summer period. Respiration per unit weight of seston was always greater at the cool station. Standing crops of seston were generally greater at the warm station and reached their maximums at both stations during the winter. Although depth profiles at the two stations indicated increases in near-surface rates, primary productivity per unit area was less influenced by the thermal effluent than was respiration because of an offsetting decrease in carbon fixation with depth at the warm station. Ratios of productivity to respiration are presented and discussed. (auth)

32176 (CONF-730505-, pp 475-489) TOTAL METABOLISM OF THERMALLY AFFECTED COASTAL SYSTEMS ON THE WEST COAST OF FLORIDA. Smith, W. H. B.; McKellar, H.; Young, D. L.; Lehman, M. E. (Univ. of Florida, Gainesville). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

The total community metabolism of estuarine bay systems receiving thermal discharge from an electric power generating station on the west coast of Florida was measured. Studies were made in summer and winter using the free water diurnal oxygen curve method. Mean summer values of both net daytime photosynthesis and night respiration in the bay systems were about 4 to 5 g O_2 m^{-2} day^{-1}. Winter values were generally one-half to one-third the summer values. No significant difference between affected and control areas was demonstrated. Summer and winter photosynthesis/respiration (P/R) ratios were 1.14 and 0.91, respectively, in the plume-affected areas, and 0.96 and 0.63, respectively, in the control areas. Total metabolism was also measured in the intake and discharge canals of the power plant. These studies indicated that both canal systems were highly heterotrophic, with P/R ratios ranging from 0.02 to 0.50. During October total metabolism (net daytime production plus nighttime respiration) was 4.7 g O_2 m^{-2} day^{-1} in the intake canal and 15.3 g O_2 m^{-2} day^{-1} in the discharge canal. During February total metabolism was 3.1 and 8.6 g O_2 m^{-2} day^{-1} for the intake and discharge canals, respectively. The 5×10^5 m^2 of canals produced 70 to 75% less oxygen than the same area of bay ecosystem and respired about 1.5 times more oxygen than the same area of bay. (auth)

32177 (CONF-730505-, pp 490-507) EFFECT OF THERMAL STRESS ON PHYTOPLANKTON PRODUCTIVITY IN CONDENSER COOLING WATER. Gurtz, M. E.; Weiss, C. M. (Univ. of North Carolina, Chapel Hill). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Investigations of the effects of passage through a condenser on phytoplankton productivity and subsequent growth are reported. Samples before and after passage through a condenser were collected simultaneously for three different levels of temperature rise (ΔT = 10, 20, and 30°F; 5.6, 11.1, and 16.7°C) on six dates at the Allen coal-fired electricity-generating plant on Lake Wylie, N. C. Controlled cooling rates appropriate to the average seasonal meteorological conditions and temperatures involved were applied to the samples. Productivity was measured with the ^{14}C method at several times during the cooling period, including a final determination after 26 hr. A relationship was found between the intake temperature, ΔT, and primary productivity. Relatively constant inhibitions occurred for a 10 or 20°F rise in temperature, regardless of the initial temperature, although a trend toward greater inhibitions at initial temperatures greater than 83°F (28.3°C) was suggested. A ΔT of 30°F produced successively greater inhibitions in productivity with increasing intake temperature. Maximum inhibition occurred during the first 1 to 2 hr of cooling, and neither further inhibition nor recovery was observed during the remainder of the 26-hr cooling period. Other results suggest that some stimulation of photosynthesis may have been related to mechanical effects of condenser passage. Implications of findings for power-plant design are also discussed. (auth)

32178 (CONF-730505-, pp 508-517) INFLUENCE OF TEMPERATURE ON THE PHOTOSYNTHETIC EFFICIENCY IN NATURAL POPULATIONS OF MARINE PHYTOPLANKTON. Yentsch, C. S. (Univ. of Massachusetts, Gloucester); Yentsch, C. M.; Strube, L. R.; Morris, I. 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Water temperature in the coastal waters of the Gulf of Maine ranges from approximately −1.5 to 18°C. In this study the temperature for maximum photosynthetic efficiency was usually found to be higher than the water temperature at the time of sampling. Generally, it was optimal at about 17°C during winter and summer. There was no indication that cold-water populations had adapted to cold temperatures. In fact, all evidence showed a preference for higher temperatures. A curve describing the relationship between temperature and photosynthetic efficiency was derived from data points. The shape of the curve is consistent with the shape of curves obtained experimentally from cultures and natural populations. The curve provides a means of assessing the influence of temperature exclusively. The assessment shows temperature largely controlling photosynthesis during winter and early spring. Control is shared, however, by other stresses (probably nutrient limitation) during warmer months. (auth)

32179 (CONF-730505-, pp 518-531) EFFECT OF THERMAL EFFLUENTS ON THE MARINE BIOLOGY OF SOUTHEASTERN FLORIDA. Thorhaug, A. (Univ. of Miami, FL). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Biscayne Bay and adjacent Card Sound are shallow estuaries receiving heated effluents from fossil-fuel and nuclear power plants. Two fossil-fuel plants discharged into Biscayne Bay during 1968–1971. Significant changes that occurred in the benthic communities are related to the temperature levels of the effluents. A second longer canal was opened in February 1972 to carry effluents from both the fossil-fuel and the two nuclear units from Turkey Point to Card Sound. Effects of silt and heat on the marine communities dominated by Thalassia and various species of green and red algae were compared to baseline data obtained in Card Sound in 1971. (auth)

32180 (CONF-730505-, pp 532-550) STUDIES OF FLORIDA GULF COAST SALT MARSHES RECEIVING THERMAL DISCHARGES. Young, D. L. (Univ. of Florida, Gainesville). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Two Florida Gulf Coast salt marshes were studied over an annual cycle to document marsh-ecosystem response to thermal additions from an electricity-generating station. The overall marsh metabolism, including plant production and respiration, and selected animal-population numbers were chosen as indicators of the impact of thermal additions. Water temperatures in the thermally affected marsh averaged 3 to 6°C warmer than in the nearby control marsh. The maximum water temperatures recorded during the summer were 37° in the thermal marsh and 32°C in the control marsh. The apparent net production, calculated from measurements of monthly changes in Spartina alterniflora live and dead standing crops, including estimates of decomposition and export during the spring growing season (February–May), was 547 g (dry weight)/m^2 in the thermal marsh, compared with 282 g (dry weight)/m^2 in the control marsh. The community metabolism measurements performed with CO_2 gas-analysis equipment in March 1973 indicate community respiration of 5.71 g C m^{-2} day^{-1} in the thermal marsh and 2.21 g C m^{-2} day^{-1} in the control marshes. The overall effect of higher water temperature appears to be higher levels of organic-matter turnover and metabolism with a ratio achieved between production and respiration which is similar to control marshes. Population comparisons indicate no significant difference in snail numbers, although fiddler crabs appear to be less numerous in the thermally affected marsh. (auth)

32181 (CONF-730505-, pp 551-561) POPULATION ECOLOGY OF PARASITES IN TURTLES FROM THERMALLY ALTERED AND NATURAL AQUATIC COMMUNITIES. Bourque, J. E. (Savannah River Ecology Lab., Aiken, SC); Esch, G. W. 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

The influence of thermal loading on parasite population biology was examined in emydid turtles from several types of aquatic habitats on the Savannah River Plant area, Aiken, S. C. Host populations from natural, thermally altered, and post-thermal recovery ponds and river swamps were compared in terms of percent incidence of parasitic infection, frequency distribution of the infection, and mean parasite burden. Different groups of parasites reacted dissimilarly to thermal modification of habitat. Nematode levels increased in heated river swamps but decreased in heated ponds when compared with similar natural habitats. Trematodes were adversely affected, but certain species of Acanthocephala increased in heated habitats. Thermal modification resulted in protracted (at least 9 years) change in parasite population levels after final thermal input. (auth)

32182 (CONF-730505-, pp 562-571) EFFECT OF THERMAL EFFLUENTS FROM NUCLEAR REACTORS ON SPECIES DIVERSITY OF AQUATIC INSECTS. Howell, F. G.; Gentry, J. B. (Savannah River Ecology Lab., Aiken, SC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Aquatic insect populations of thermal, post-thermal, and natural streams on the Savannah River Plant site near Aiken, S. C., were compared according to species composition and diversity. Plecopterans, odonates, ephemeropterans, and trichopterans showed a trend of increasing importance in both numbers of individuals and numbers of species from thermal to post-thermal to natural streams. Insect communities in the natural stream had the highest diversity indexes; communities in the post-thermal stream had intermediate diversity estimates; communities in the thermal stream had the lowest diversity estimates. Evenness showed heterogeneity of variances with variance of the estimates decreasing from thermal to post-thermal to natural streams. This increased variance appears to be related to environmental stress produced by reactor effluents. In the aquatic habitats sampled, species-diversity and evenness estimates were reliable indicators of environmental stress. (auth)

32183 (CONF-730505-, pp 572-578) BIRD DIVERSITY AND THERMAL STRESS IN A CYPRESS SWAMP. Straney, D. O.; Briese, L. A.; Smith, M. H. (Savannah River Ecology Lab., Aiken, SC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Thermal effluents increase the variances but decrease the means of diversity and evenness estimates for bird species in a cypress swamp. Changes in species composition indicate that nonaquatic birds show a direct response to thermally induced changes in the structural elements of the habitat. Woodpeckers take advantage of standing dead trees for food and shelter in thermally affected and post-thermal recovery areas; passerines are most affected by the amount of canopy and ground cover. (auth)

32184 (CONF-730505-, pp 579-593) ABUNDANCE AND DIVERSITY OF WATERFOWL INHABITING HEATED AND UNHEATED PORTIONS OF A REACTOR COOLING RESERVOIR. Brisbin, I. L. Jr. (Savannah River Ecology Lab., Aiken, SC). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Census counts were made of waterfowl inhabiting both heated and unheated portions of an 1120-ha cooling reservoir receiving heated effluents from an atomic production reactor. Of 6544 birds, over 99% were counted between the months of October and April. Over 66% of those identified to species were American coots. Although the heated and the unheated study areas were less than 4 km apart and birds could freely move between them, significant differences were observed in the numbers and species diversity of the waterfowl. Significantly more birds and a greater species diversity were found in the unheated area; diversity differences were mainly attributable to a decrease in species richness in the heated area. Dabbling ducks were absent from the heated area and seemed more thermally sensitive than diving ducks. Certain species of diving ducks, such as the lesser scaup, appeared to exhibit a greater degree of ecological thermal tolerance than other species, e.g., the ring-necked duck. Pied-billed grebes seemed to show the greatest ecological thermal tolerance, occurring in equal numbers in both heated and unheated areas. (auth)

32185 (CONF-730505-, pp 610-627) POTENTIAL USE OF VEGETATION TO ENHANCE COOLING IN HOLDING PONDS. Miller, P. C. (California State Univ., San Diego). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Coastal mangrove swamps may become areas where heated waters from power plants are released. Rather than removing the mangroves to create a cooling pond, the mangroves could be left intact and the hot water allowed to flow underneath the mangrove canopy. The canopy could then shade the surface and increase the turbulent transfer of heat and water vapor from the surface. A mathematical model of heat and water-vapor transport through mangrove canopies and of water relations and carbohydrate production has been developed and tested against measurements in red mangroves in south Florida. Simulations with the model using realistic water flow rates and extreme environmental conditions indicated that if the vegetation were left intact the natural environment would be much less affected and the water would cool to ambient before recycling through the power plant. A leaf-area index (Lai) of about 1.0 should provide the maximum cooling with the least detrimental effect on the mangroves themselves. Carbohydrate production in canopies with smaller LAI will be negative with high solar intensities, and canopies with larger LAI will reduce the transfer of heat and water vapor from the surface. The mangroves are expected to experience increased, but not severely detrimental, water stress owing to the hot water. These results should be generally applicable to subtropical and tropical vegetation in swamps in the southern United States and indicate that the possibility of leaving the vegetation intact should be considered further in designing cooling ponds. (auth)

32186 (CONF-730505--, pp 628-649) ENERGY COST-BENEFIT MODELS FOR EVALUATING THERMAL PLUMES. Odum, H. T. (Univ. of Florida, Gainesville). 1974.

From thermal ecology symposium; Augusta, Georgia, USA (3 May 1973).

In thermal ecology.

Systems models, analog computer simulations, energy cost-benefit tabulations, and measurements of productivity and total metabolism are used to consider the role of increased temperature inflows at Crystal River, Florida. The estuary has received a power-plant thermal plume for 6 years. The potential energy content of heat flows in the gradient is calculated as an auxiliary energy source, and the role of elevated temperature is considered as affecting productivity and recycling. Energy circuit diagrams and simulations are given for Eyrings's model, for Morowitz's order model having autocatalytic temperature action, and for a model with more complex nutrient and sewage recycle actions of temperature. In most models increases in temperature serve as both a push and a pull action on orderly structure. Increased temperature may increase the system's total productivity and useful power if the temperature change is accompanied by increased resources with which to interact. Experience with microcosms and measurements at Crystal River bear out the suggestions from models that power plants may have neutral or positive energy impacts on estuarine ecosystems if the ecosystems are given time for self-designing adaptation. The negative energy impact of these alternatives may be much less than the large energy cost to the general economy of man and nature caused by cooling towers. (auth)

32187 (CONF-740820-3) ANALYSIS OF THREE YEARS OF COMPLETE-FIELD TEMPERATURE DATA FROM DIFFERENT SITES OF HEATED SURFACE DISCHARGES INTO LAKE MICHIGAN. Kyser, J. M.; Paddock, R. A.; Policastro, A. J. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-eng-38. 58p. (SM-187/42). Dep. NTIS $6.00.

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974).

Temperature data taken from prototype thermal plumes from single (and, in one case, double) surface outfalls under varying environmental conditions have been systematically analyzed. Three-dimensional temperature data were taken at four sites on Lake Michigan by an instrument-equipped boat. In total, 15 plumes from Palisades, 22 from Point Beach Unit 1, six from Point Beach Units 1 & 2, two from Waukegan and one from State Line were analyzed in terms of their major plume characteristics. Of most significance to plume dispersion at these sites were current speed and direction, wind speed and direction, and ambient lake turbulence. Plume characteristics of centerline temperature decay, temperature half-widths, and isotherm areas showed wide variation at a site as environmental conditions changed from one plume to the next. It was also found, however, that the Palisades and Point Beach Unit 1 data each fit rather neatly into five categories distinguished by ranges in current, wind, and lake conditions. Finally, plumes from the above four sites were compared for similar environmental conditions (stagnant or small ambient currents). The Waukegan site demonstrated the most rapid plume dilution in terms of centerline temperature decay and isotherm areas due to its large outfall densimetric Froude Number (≈9.7). The State Line site with its low initial densimetric Froude Number (≈1) showed the least rapid plume dispersion. The Point Beach Unit 1 and Palisades discharges, although having nearly equal heat-rejection rates and initial densimetric Froude Numbers (≈2.4), had significantly differing plume characteristics due to the large outfall aspect ratio difference and secondarily upon the magnitude of site-dependent ambient currents. The Palisades plumes had a generally slower centerline temperature decay and larger areas than Point Beach due mainly to its much larger aspect ratio. (auth)

32188 (PB-228659) THERMAL EFFECTS ON BIOLOGICAL PRODUCTION IN A POND. Siewert, H. F. (Wisconsin Univ., Madison (USA)). 1973. Contract DI-14-01-0001-1870. 186p. NTIS $12.50.

Thesis.

Physical, chemical, and biological differences between two similar ponds were studied. One pond was heated to 5C above ambient temperature, while the other served as a reference. Two hundred and fifty green sunfish, Lepomis cyanellus, were planted in each pond. The young-of-the-year grew at a higher rate in the heated pond and permitted Chara to grow year round at an accelerated rate. The heated pond produced more oxygen during the day and lost more oxygen during the night than did the reference pond. There was an indication that the synergistic effect of temperature and oxygen with an unlimited food supply will promote fish growth. (GRA)

32189 VEGETATION OF SWAMPS RECEIVING REACTOR EFFLUENTS. Sharitz, R. R. (Univ. of Georgia, Athens); Christy, E. J.; Irwin, J. E. Oikos; 25: No. 1, 7-13(1974).

Vegetational properties of mixed hardwood swamps exposed to different thermal regimes from the release of nuclear reactor effluents were compared on the bases of floristic similarity, importance values of the dominant species, and diversity. Floristic composition was greatly altered by high water temperatures and by increased flooding and silting associated with the discharge of reactor effluents. Although the forest canopy was destroyed, diversity of the herbaceous flora remained high under conditions of thermal loading and post-thermal recovery. Trees comprise 40% of the species present in the undisturbed swamp habitat and less than 10% in the stressed areas. Successional recovery of the swamp following removal of the stress is slow. Such studies are valuable in assessing the responses of natural systems to the introduction and ultimate removal of nuclear reactor effluents. (auth)

Chemical Effluents

Refer also to abstracts 31712, 32010–32019, 32033, 32035–32038, 32040, 32042, 32092, 32093, 32102, 34301, 34460, 34462, and 34470.

32190 (AED-CONF-73-231-002) FUTURE ASPECTS: ENERGY SUPPLY–ENVIRONMENT. Speich, P. (Rheinische Braunkohlenwerke A. G., Koeln (F. R. Germany)). 1973. 31p. (In German). (CONF-7305100-1).

From water and electricity meeting; Garmische-Partenkirchen, F. R. Germany (29 May 1973).

The energy consumed in the Federal Republic is expected to double by 1985. To cover the growing demand mainly mineral oil, gas, and increasingly nuclear energy are used. Increasing share

of household consumption is a result of increasing comfort needs. The effects of this development on the environment and measures to minimize emissions are described. Some examples of improved utilization, saving possibilities and new conversion techniques are shown. Using the Rhine brown coal area as an example, the environmental effects due to a gain of energy and conversion as well as possible environmental conditions are explained. (GE)

32191 (ANL-8060(Pt.3), pp 63-76) DISTRIBUTION OF ^{210}Pb AND STABLE LEAD IN LAKE MICHIGAN SEDIMENTS. Edgington, D. N.; Robbins, J. A.; Karttunen, J. O. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

The distribution of lead in several cores taken in 1972 from the southern half of Lake Michigan was measured. These particular cores were chosen because the profiles of ^{210}Pb and ^{137}Cs and porosity for each one had already been measured and their sedimentation rates and mixing depths calculated. The stable lead concentration was measured by atomic absorption spectrophotometry using aliquots of the same solutions used for the determination of ^{210}Pb. In order to arrive at a quantitative prediction of the profiles of lead in sediment cores, it is necessary to construct an atmospheric source function based on historical data for lead emissions and usage and then determine the possible influence of other than atmospheric sources. In an attempt to reconstruct the observed profiles for lead in sediment cores, an emissions inventory was constructed for this element based on the burning of coal from 1830 and gasoline from 1910 to the present. This inventory is presented in terms of tons of lead emitted to the atmosphere each year for each fuel separately. The inventory was calculated on the assumption that 4% (the same as the fraction of the total U. S. population residing in the Gary–Chicago–Milwaukee area) of the national production of coal and gasoline each year was consumed in this area. It is assumed that 25% of the lead in gasoline is released to the atmosphere and becomes airborne, and that the average gallon of gasoline contains 2.4 g of lead. (CH)

32192 (ANL-8060(Pt.3), pp 77-84) DISTRIBUTION OF TRACE ELEMENTS IN THE CLAY-SILT SEDIMENTS OFF GRAND HAVEN. Robbins, J. A.; Edgington, D. N. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

The dispersion of trace elements (Fe, Mn, Mg, Ca, Sr, Cu, Zn, Cr, Ni, Na, and K) into the inshore region due to the discharge of the Grand River into Lake Michigan at Grand Haven was studied. In spite of the ability to visually observe the dilution of the plume in terms of either turbidity or dissolved ion content generally within a mile of the shore, examination of grab samples showed that there was little or no evidence of any sedimentation of clay or organic material in this close inshore area. The initial sam pling showed that there is no settling of fine-grained silts and clays up to a distance of 6 miles offshore, presumably because turbulence effects due to wave action and lake currents keep the fine, less dense, nonquartz particles in suspension. The combined effects of internal and wind-induced currents in the lake (which run predominantly north-south) contribute to a band of high sedimentation which runs parallel to the shoreline from 4 to 17 miles offshore. A possible bimodal distribution of certain trace elements in the sediments has been observed to the north and south of the mouth of the Grand River. However, the contributions to the sediments from all the rivers entering the east side of Lake Michigan tend to merge into a single-line sink in which sedimentary inputs from all the rivers are combined. It was concluded that some of the apparent complexities in the distribution of trace elements in these cores may be resolved simply by the concurrent measurement of sedimentation rate using ^{210}Pb and the determination of major constituents which may be involved in their transport to the sediments or subsequent diagenesis in the sedimentary column. (CH)

32193 (ANL-8060(Pt.3), pp 160-164) TERRESTRIAL ECOLOGY: INTRODUCTION. Jordan, C. F. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

The new direction of the Terrestrial Ecology Program at Argonne is toward evaluating the economic impact of non-nuclear energy sources upon agricultural crops. Soybeans were chosen as a crop for study because of their rapidly increasing importance as a human protein source. Sulfur dioxide was chosen as a pollutant because of its current and projected importance as an air pollutant. The projections for coal use and associated SO_2 emission indicate that both will increase in the next decade in the U. S. Unpolluted air has an SO_2 concentration of about 3.5×10^{-3} ppM and the highest annual averages of SO_2 in urban areas in the United States now are close to 1.5×10^{-1} ppM, with periodical concentrations exceeding 1 ppM. (CH)

32194 (ANL-8060(Pt.3), pp 165-176) ENERGY ALLOCATION IN BEANS (PHASEOLUS VULGARIS L.) FOLLOWING SULFUR DIOXIDE EXPOSURE. Jordan, C. F.; Koziol, M. J. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

In response to sulfur dioxide stress due to air pollution bean plants (Phaseolus vulgaris) diverted energy away from synthesis of new tissue and away from storage, and kept energy available in the form of sugars in order to repair and replace damaged cells. This diversion resulted in an increase in respiration, a decrease in net photosynthesis, and a decrease in crop production. (auth)

32195 (JPRS-61048) TRANSLATIONS ON ENVIRONMENTAL QUALITY. Number 7. Translated from various journals (23 Jan 1974). 41p. NTIS $3.25.

Included in the translated articles are: antipollution measures in Czechoslovakia; water pollution in Brazil; natural resources in Colombia; and radioactive pollution, environmental hygiene, industrial wastes, non-polluting energy sources, and noise pollution in the USSR. (GRA)

32196 (LBL-2748) SUPERSONIC AIRCRAFT AND THE OZONE LAYER. Johnston, H. S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1974. Contract W-7405-eng-48. 52p. Dep. NTIS $5.45.

Model calculations including atmospheric motions and the photochemistry of oxygen, water, and nitrogen oxides indicate that 500 supersonic transports would reduce the stratospheric ozone shield between 3 and 30 percent. Stratospheric ozone has been observed to change with solar-cycle modulated cosmic rays, presumably by virtue of the nitric oxide produced. The ozone data for the period from 1960 to 70 are consistent with a small decrease and then increase of ozone associated with nitric oxide from nuclear-bomb tests. These observed changes of ozone with nitric oxide indicate a greater sensitivity of stratospheric ozone to nitric oxide than is given by most model calculations. (auth)

32197 (WASH-1332(74)(Vol.1), pp 361-385) DISPOSAL OF OIL WASTES BY MICROBIAL ASSIMILATION. Napier, J. M.; Francke, H. C. (Oak Ridge Y-12 Plant, TN). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

A biological assimilatory process for the disposal of plant oil waste products was successfully demonstrated. The process involves mixing waste petroleum products and commercial fertilizers into the soil where naturally occurring microbial assimilation results in destruction of the oily wastes. The experimental work included laboratory and large-scale field tests. The studies showed that more than 30,000 gallons per year per acre of plant oily wastes can be discarded with this process. Carbon dioxide evolution rates from the test plots and chemical analysis showed that the oil wastes are being effectively decomposed. No evidence has been observed that indicates oil infiltration into the lower soil horizons or contamination of the ground water or adjacent streams. (auth)

32198 (WASH-1332(74)(Vol.1), pp 413-425) LAND SPREADING OF INDUSTRIAL WASTE WATER AND THE EFFLUENT FROM A SECONDARY SEWAGE TREATMENT FACILITY. Ward, W. E.; Gray, D. V. (General Electric Co., St. Petersburg, FL). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

A spray irrigation system used for the advance treatment of sanitary and industrial wastes is described. The various phases of the treatment system are discussed and data presented which indicates the efficiency of land spreading in removing normal pollutants. (auth)

32199 (WASH-1332(74)(Vol.2), pp 1101-1113) MOUND LABORATORY'S RECLAMATION AND RECYCLING PROGRAM. Garbe, Y. M. (Monsanto Research Corp., Miamisburg, OH). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

In keeping with Mound Laboratory's tradition for innovation and forward-looking action, several studies were recently conducted to seek out alternatives to incineration and landfill of all nonradioactive solid waste. Efforts were directed towards reclamation, reuse, and recycling of solid wastes. These efforts resulted in a

reclamation and recycling program that is being implemented in three separate phases: Phase I provides for reclamation and recycling of IBM cards, printouts, and white paper. Phase II is designed for reclamation, recycling, or off-site disposal of all wastes generated in buildings and areas where radioactive or explosive wastes are not contained. Phase III provides for reclamation, recycling, or off-site disposal of the remaining wastes not included in Phases I and II. Implementation would follow successful operation of Phases I and II and would only be implemented after a complete analysis of monitoring and segregation techniques have been established to assure against any possibility of off-site contamination. (auth)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstracts 31612, 31613, 31997, 32437, 32603, and 34016.

32200 WHOLE-BODY MEASUREMENT TECHNIQUES AT THE SWEDISH NATIONAL INSTITUTE OF RADIATION PROTECTION. Falk, R.; Magi, A.; Swedjemark, G. A. (Soedersjukhuset, Stockholm). Acta Radiol., Suppl.; No. 310, 94-113 (1971).

In the low-activity laboratory of the National Institute of Radiation Protection there are three types of whole-body counters: an ionization chamber, an "open-booth" counter and a whole-body scanner. In particular the whole-body scanner, which is of ground measurements, calibration measurements and other measurements are reported. The size and distribution of the measuring errors in an in vivo measurement are estimated. (auth)

General Detectors and Monitors

Refer also to abstracts 32048, 32285, 32324, 32642, 33073, 34257, and 34492–34494.

32201 (ANL-CT-74-45824-0003) HERMETIC AND ELECTRICAL TESTING OF EIMAC END-SEAL NO. 1. Brewer, J.; Cassidy, C. J. (Argonne National Lab., Ill. (USA)). 23 May 1974. Contract W-31-109-eng-38. 40p. AT.

The results of tests performed on Eimac End-Seal No. 1 without a center conductor through the seal assembly are presented. The testing included hermeticity at room temperature and electrical performance in an air atmosphere at temperatures up to 850°F with up to 1000 volts dc applied. The end-seal was designed for use as a hermetic electrical feedthrough insulator for neutron detector coaxial cable termination. The helium leak tests were performed according to RDT Standard F 3-11, Section 3.5.5.2, Procedure II-Gross Leak Rate Measurement both before and after the series of end-seal electrical tests at elevated temperatures. The electrical tests were performed in accordance with RDT Standard F 3-39 except that both negative and positive polarities were used for the breakdown voltage and breakdown pulse noise (BPN) tests and also the counting system gain used throughout all temperature ranges was fixed and determined at room temperature. The hermeticity of the end-seal did not survive the 32 days at 850°F with an air atmosphere during electrical testing. (WHK)

32202 (ANL-CT-74-45824-0006) SUMMARY OF TEST RESULTS FROM EXPERIMENT NI-2 FOR THE RSN-286, S/N M402 AND THE WX-31384, S/N 703902 FISSION COUNTER-CHAMBERS BEING TESTED IN THE EBR-II NITF J-2 THIMBLE AT 700°F. Reactor Run 63 (June 1973) thru Run 66 (November 1973). Yingling, G. E. (Argonne National Lab., Ill. (USA)). 1 Jun 1974. Contract W-31-109-eng-38. 72p. AT.

This report presents a summary of test results from the testing of two fission counter-chambers in the EBR-II J-2 thimble of the Nuclear Instrument Test Facility (NITF). The two fission counter-chambers being tested as Experiment NI-2 are a Reuter-Stokes model RSN-286, S/N M402, and a Westinghouse model WX-31384, S/N 703902. Summary information on the detectors performance is provided. The mating of the detectors to the Experimental Tests Instruments in May 1973, Reactor Runs 63 thru 66 and the following shutdown until the experiment test temperature was increased to 800°F in November 1973 are described. During the period from October 1972 thru May 1973, the detectors were mated to commercial Wide Range Neutron Monitoring Systems and operated throughout the reporting period at 700°F. The RSN-286 detector test results indicate little, if any, change in performance over this reporting period. The WX-31384 detector test results indicate a decreasing BPN voltage threshold with each succeeding reactor run. (WHK)

32203 (BNWL-1850(Pt.4), pp 1-39) INSTRUMENTATION TECHNOLOGY. Feb 1974.

In Pacific Northwest Laboratory annual report for 1973 to the USAEC Division of Biomedical and Environmental Research.

The development of radiochemical instrumentation and analytical technology required for analysis of biomedical and environmental samples and their application in (a) research studies to characterize the inventories and the routes and rates of transport of natural, tracer or waste radionuclides in environmental systems, (b) comparison of radioelement and stable element counterpart behavior in the environment, and (c) the study of physical and chemical transformations which occur and affect the transport and uptake processes is summarized. Also, research in the application of nuclear technology and radioisotopes to medicine and biology by combining the advanced knowledge, techniques, and instrumentation of the nuclear field with the talent and knowledge of the medical profession to improve and to increase the direct medical benefits to mankind is described. Advanced instrumentation concepts, detectors, and circuitry are also being developed for use in health physics environmental studies, particularly in measuring in vivo plutonium and other alpha emitters. These studies usually culminate in a cooperative effort with a medical institution for their practical application. (auth)

32204 (INIS-mf-1370) COMPUTER-CAMAC CONTROLLED SCANNING WHOLE-BODY COUNTER IN CLINICAL DIAGNOSIS. Heer, H.; Halling, H. (Kernforschungsanlage Juelich G. m. b. H. (F. R. Germany)). [nd]. 4p. INIS.

From first international symposium on CAMAC and online computers; Luxembourg (4 Dec 1973).

A PDP-11/2C DOS-System (1,2 Megaword disc RK05, Dual Dectape) using CAMAC peripherals, with stepper motor controllers, interface modules for ADC's interrupt registers and scalers is controlling a whole body counter. The total measurement procedure consisting of automatic adjustment using an anatomical model, set up of prologue data holding information about specific measurements and patient parameters, scanning and measurement program, on-line data acquisition and storage on disc as well as final control-procedures is done by the system using FORTRAN and MACROS. An important feature of the system is the simplicity of handling the system by untrained personnel. (INIS)

32205 (KFTI-73-26, pp 85-86) CHARGE PREAMPLIFIER ON FIELD TRANSISTORS FOR SURFACE-BARRIER DETECTORS OF LARGE SURFACE. Borzhkovskii, V. F.; Cherkasov, A. S.; Vlasov, V. G.; Zalyubovskii, I. I.; Zagnojko, N. K.; Frolov, A. I.; Grishaev, I. A.; Mocheshnikov, N. I. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High Physics and Nuclear Physics.

A diagram is given for a charge preamplifier for work with semiconductor radiation detectors. The properties of the preamplifier were: noise 5.5 ± 16.5 keV; amplifier coefficient without reverse connection, 15,000 to 60,000; amplifier differentiation and integration constants, 0.5 μsec. (INIS)

32206 (NYO-3406-5) SCINTILLOMICROSCOPY. Technical Report No. 5. Reynolds, G. T. (Princeton Univ., N. J. (USA)). 2 Oct 1967. Contract AT(30-1)-3406. 26p. Dep. NTIS $4.50.

A method of detecting weak radioactivity in biological systems by means of image intensification of the scintillation signal from the radioactive decay products is described. The biological specimen is placed on a conventional slide in an optical microscope and covered with a thin scintillator. An image intensifier is coupled to the microscope. (WHK)

32207 (SGAE-2286) SIMPLE AUTOMATIC SAMPLING DEVICE FOR ENVIRONMENTAL TRITIUM AIR MONITORING. Duftschmid, K. E. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf, Inst. fuer Strahlenschutz). May 1974. 16p. (CONF-740523-3). Dep. NTIS (US Sales Only) $4.00.

From 7th international congress of the French Society for Radioprotection; Versailles, France (28 May 1974).

Monitoring of airborne tritium (HTO) concentration plays an important role for the assessment of environmental hazard caused by nuclear installation. A simple automatic monitoring device has been developed which provides high detection sensitivity at minimum labor and equipment expense. The technique used is an improvement of the well-known "cold-pipe" sampler. Air is drawn through the cold-trap of a thermoelectric cooler by the pump of a small vacuum cleaner and the condensed water collected in the counting vial of a liquid scintillation counter. Once a day the vial is automatically changed by a simple rotating tray mechanism. Every week the samples are removed and assayed with no further sample preparation. This way also increased sensitivity as compared to the generally used "bubbler" is achieved as there is no dilution of the sample. Due to frequent electric defrosting of the cooler the airflow is sufficiently constant to make volume measurement or calculation via temperature/humidity unnecessary. The limit of detection is in the range of 10 pCi/m^3 equivalent to

5.10^{-6} $(MPC)_a$ for continuous occupational exposure. The prototype unit has been field-tested at the site of the Austrian Reactor Center Seibersdorf. The test results show that reliability and economy of environmental tritium contamination monitoring can be significantly improved by this simple device. Due to its nearly unattended and continuous operation the sampler is especially suitable for extended monitoring networks around nuclear installation (auth)

32208 (UCID-15896) ARPA PHOTON DETECTOR DEVELOPMENT. Armantrout, G. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Aug 1971. 37p. Dep. NTIS $5.00.

Research to develop a high-energy photon detector which has a maximum attainable efficiency without significant reduction in resolution over that attainable with present high-quality Ge(Li) detectors is described. (Ge(Li) detectors as such are not suitable due to their inherent instability and low operating temperature requirements). Lithium stability studies and elevated operating temperature studies are reported that did not meet with much success. Also, high purity Ge detector fabrication studies are reported, and it was determined that this will be the direction of future research. (WHK)

32209 (UCID-15912) TEST RESULTS ON TIME RESOLVED DETECTION OF X-RAY PULSES USING MOS-C DETECTORS. Kalibjian, R.; Ciarlo, D.; Mayeda, K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Sep 1971. 30p. Dep. NTIS $4.50.

Time resolved detection of 20, 10, and 5 ns resolution is reported for x-ray detection using a sequentially scanned MOS-C detector. The detection scheme is based primarily on the trapping of charge carriers (generated by Compton electrons due to x-rays) in a dielectric layer. Readout of the stored charge is performed by the metal-oxide-semiconductor-capacitor (MOS-C) method. The time resolved detector is fabricated by utilizing a linear array of detectors that is scanned time sequentially as a time framing recorder for radiation pulses. Measurement data are given and discussed. (WHK)

32210 (UCRL-75756) HIGH SPEED RADIATION CAMERA USING A PTM RUBY LASER AND HYDRATED ELECTRON ABSORPTION PHENOMENA. Coutts, G. W.; Olk, L. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Jul 1974. 11p. (CONF-740915-1). Dep. NTIS $4.00.

From 11th international congress on high speed photography; London, UK (15 Sep 1974).

In an attempt to circumvent timing limitations imposed by scintillators and gated image intensifiers, we have developed a twelve-frame radiation camera incorporating a Pulse Transmission Mode (PTM) ruby laser and employing the transient absorption phenomena associated with the hydrated electron. An ionizing radiation pulse absorbed in an acidic aqueous cell generates an absorption pattern which is characteristic of the time-space pulse profile. A 2.5 ns laser pulse is split into 12 separate beams which sequentially strobe a radiation sensitive image cell and transfer 12 time samples of the changing absorption pattern to photographic film. Thus, the exposure time for this system is limited by the laser pulse width and the mean lifetime of the hydrated electron absorption centers. With a 2.5 ns laser pulse and interframe times set at 3 ns, high resolution photographs of a Febetron 705 pulsed electron beam interacting with aqueous solutions were obtained. Images obtained during the rise of the electron pulse indicate a sharp increase in the electron energy. Photographs obtained during the pulse decay indicate a large number of relatively lower energy electrons. (auth)

32211 DETERMINATION OF THE OPTIMUM WINDOW FOR WHOLE BODY COUNTING OF ^{47}Ca. Carrejas, M. L. (Buenos Aires Univ. Nacional); Mendez, M. A.; Soria, N.; Pecorini, V.; Degrossi, O. J. Int. J. Nucl. Med. Biol.; 1: No. 4, 223-225(Jun 1974).

Experimental and computed data concerning the determination of the optimum window to measure ^{47}Ca in a whole body counter in which the detector is a single NaI(Tl) crystal are presented. Two experiments were carried out in phantoms, varying the longitudinal distribution of radioactivity, and increasing the depth of the absorption media. The results showed that: (i) the energy band corresponding to 0.57 to 0.73 MeV is the best to measure ^{47}Ca, and (ii) estimated accuracy when a patient is measured using the optimum energy band is 7 per cent. (UK)

32212 DAMAGE TRACK REGISTRATION RELATED TO THE THERMAL STABILITY OF THE POLYMERS. VIII. International Conference on Solid State Track Detectors. Marchetti, M.; Tommasino, L.; Casnati, E. (CNEN, Casaccia, Italy). Radiat. Eff.; 21: No. 1, 19-24(1974).

Damage track registration in organic insulators is affected by morphological and chemical changes of the polymers. On the other hand it is possible to produce various typical morphological and chemical deteriorations in organic polymers by simple heat treatments, according to the thermal stability of these materials. Extensive investigations are reported which relate the thermal stability and the registration properties of various organic track detectors which received different heat treatments. The thermal stability of the organic insulators has been analyzed by a Differential Scanning Calorimeter (DSC). The effects of the thermal treatments on track registration have been studied by measuring the track diameters of fission fragments after a given etching time, as a function of the temperature of the heat treatments. For cellulose derivatives the track counts of alpha-particles from a thick natural uranium foil have been taken to evaluate the registration property changes. Both the track diameters and the counts of alpha-particles change as a function of the heat treatment temperature in a way related to the data obtained by the DSC measurements. The results obtained provide a better insight for the phenomena which affect the track registration in organic insulators. (auth)

32213 CELLULOSE ACETATE DAMAGE TRACK DETECTOR FOR PLUTONIUM CONTAMINATION MEASUREMENTS. Bhatt, R. C.; Singh, D. (Bhabha Atomic Research Centre, Bombay). Health Phys.; 27: No. 2, 219-220(Aug 1974).

Studies on the use of cellulose acetate film with a degrader foil combination for plutonium contamination measurements are described. This detector system will be particularly suitable for contamination measurements in areas having high γ background and may be used with advantage in situations where isolation of the detector is required to prevent the transfer of contamination during measurements. (UK)

32214 FOLD BACK AT HIGH EXPOSURE RATES OF INSTRUMENTS USING HIGH PRESSURE IONISATION CHAMBERS. Hudd, W. H. R.; Walker, W. N. (Central Electricity Generating Board, Berkeley, Eng.). Health Phys.; 27: No. 2, 222-224(Aug 1974).

If γ monitors are exposed to radiation levels above the maximum indicated level, it is of absolute importance that the monitor meter should remain at full scale deflection. Tests of a commercially made monitor which uses an IG5 ionisation chamber and in which the E.H.T. current to the chamber was limited to 1 μA by a resistor in the E.H.T. supply line, showed that the monitor would "fold-back" at the radiation dose-rates expected from irradiated fuel, i.e. 10^4 to 10^6 $R.hr^{-1}$. An investigation of the chamber collector and leakage current characteristics revealed that the "fold-back" was due to the current being drawn causing the voltage at the E.H.T. electrode to fall to about 1 V, which was insufficient to overcome the off-set voltage of the collector current amplifier. Consequently all of the current flowed via the leakage path to the case. Reducing the resistor in the E.H.T. line from 10^9 to 10^6 Ω maintained the E.H.T. voltage at the chamber sufficiently high to overcome the "fold-back". When designing instruments using type IG5 or similar ionisation chambers it is therefore important to consider the consequences of chamber leakage currents, particularly under conceivable overload conditions. (UK)

32215 APPLICATION OF A COINCIDENCE COUNTING TECHNIQUE IN A FIXED GEOMETRY WHOLE-BODY COUNTER. Chen, N. S.; Ellis, K. J.; Pate, H. R.; Cohn, S. H. (Brookhaven National Lab., Upton, NY). Int. J. Nucl. Med. Biol.; 1: No. 4, 175-180(Jun 1974).

The coincidence counting technique has been applied to the Brookhaven 54-detector whole-body counter for the localization of positron-emitting radionuclides. With the spatial resolution limited by detector size, administered isotopes could be located to within 85 (17 × 5) compartments or grid-points. The dose required for a study could be as low as 1 μCi. Because of the fast data handling facilities available with the "on-line" computer, the technique is most suitable for studies involving rapidly distributed radionuclides. (auth)

32216 IMPROVED RADIONUCLIDE DISTRIBUTION PROFILE FROM A FIXED ARRAY WHOLE-BODY COUNTER USING A MATHEMATICAL ANALYSIS TECHNIQUE. Chen, N. S.; Cohn, S. H. (Brookhaven National Lab., Upton, NY). Int. J. Nucl. Med. Biol.; 1: No. 4, 169-173(Jun 1974).

A matrix analysis technique has been used to extract an improved radionuclide distribution profile from data recorded in the Brookhaven 54-detector whole-body counter. When applied to several case studies, the computed profiles revealed features that were otherwise smoothed out in the count rate profiles, and could be useful to locate organ-seeking radionuclides. However, large statistical errors and the difficulties involved in setting up the response matrix made the information obtained more of a qualitative than quantitative nature. (auth)

32217 NEUTRON FLUX INTEGRATOR. Kulikov, Yu. K.; Dergachev, Yu. T.; Voronkov, G. Ya.; Sunchugashev, M. A.; Fursov, V. V. Sov. At. Energy (Engl. Transl.); 34: No. 5, 485-486 (May 1973).

Translated from At. Energ. (USSR); 34: No. 5, 396-397(May 1973).

The operation and testing of a self-powered neutron flux monitor (rhodium emitter) in the Novo-Voronezh atomic power plant are described. With the reactor operating at a thermal power of 970 MW, the detector generated a current of 2.2 μA, which corresponds to a neutron flux at the detector location of 3×10^{13} n/cm^{2}s. The readout system is described, and the long term accuracy is estimated. (WHK)

32218 DETEKTOR- UND EXPERIMENTELEKTRONIK. (Detectors and Experimental Electronics). Stuckenberg, H. J. Nukleare Elektronik und Messtechnik. Karlsruhe, F. R. Germany; Braun (1974). 174p. (In German). (ISBN-3765025011).

The second volume of the series entitled "Nuclear Electronic and Measuring Techniques" covers the selection of detectors and their electronic circuits, the measurement of particle energy and of time relations between particles, and finally the acquisition and processing of measured data. (auth)

32219 CHEMICAL DEFECTS PRODUCED IN VARIOUS PLASTIC TRACK DETECTORS BY ELECTRON OR HEAVY-ION BEAMS. Bernas, A.; Chambaudet, A. (Univ., Paris). Radiat. Eff.; 22: No. 2, 129-134(Jun 1974). (In French).

Heavy ionizing particles produce tracks of structural or (and) chemical defects as they move through insulating materials, in particular plastic films. These latent tracks may be observed by optical microscopy after proper chemical etching. On the other hand, bombardment with energetic electrons does not give rise to such etchable tracks. Since the existence of the latter has usually been correlated with the high polymer chemical modification, a comparison has been made of the chemical effects induced by either heavy ion (Kr) or electron bombardment in a few typical plastic detectors; namely lexan, mylar and kapton. Permanent and reversible modifications are observed through infrared absorption spectroscopy. No significant difference is registered for the two types of irradiations. It is therefore concluded that the formation of etchable tracks is not associated with specific radiolysis products, but rather with a higher local density of damage in the case of heavy ion bombardments. It is, however, impossible to determine at which stage of the detector-incident particle interaction the radiolysis products spatial correlation has been crucial to the formation of latent tracks. (auth)

32220 SOME CHARACTERISTICS OF ELECTRON-EMISSION NEUTRON DETECTORS WITH Ag, ^{109}Ag, Rh, AND Gd EMITTERS. Emel'yanov, I. Ya.; Volod'ko, Yu. I.; Egorov, O. K.; Konstantinov, L. V.; Postnikov, V. V. Sov. At. Energy (Engl. Transl.); 34: No. 3, 257-260(Mar 1973).

Translated from At. Energ. (USSR); 34: No. 3, 203-205(Mar 1973).

The absolute sensitivities of electron-emission neutron detectors (self-powered detectors) with Ag, ^{109}Ag, Rh, and Cd emitters were determined in the IRT-1000 reactor core. Results are given. (WHK)

32221 HIGH INTENSITY RADIATION IMAGING SYSTEM. Barrett, H. H. (to Raytheon Co.). US Patent 3,829,688. 13 Aug 1974. Filed date 4 May 1972. 16p.

A nuclear imaging system for mapping a spatially distributed source of high energy nuclear particles from a living organ which has selectively absorbed a radioactive compound in which the nuclear energy is spatially coded by a zone plate positioned between the source and a spatial detector is described. A half tone screen is positioned between the source and the zone plate to increase the definition of the image. (22 claims, 8 drawing figures) (Official Gazette)

32222 GAMMA RAY DETECTOR WITH CHANNEL LIMITING MEANS. Hall, R. N. (to General Electric Co.). US Patent 3,825,759. 23 Jul 1974. Filed date 24 Oct 1972. 8p.

High-purity germanium gamma ray detectors are provided with at least one, and preferably a plurality, of lateral channel-limiting regions which prevent the short-circuiting of a substantial portion of the lateral surface of the detectors by spurious channels of conductivity-type opposite to that of the residual conductivity-type of the germanium. (Official Gazette)

32223 SCINTILLATION CRYSTAL. Miraldi, F. D. US Patent 3,825,758. 23 Jul 1974. Filed date 9 Apr 1973. 6p.

A plurality of elongated scintillation crystals are combined in a unit. The scintillation crystals may be either parallel bars or concentric tubular members. In either event separators such as aluminum foil may be used to prohibit signals from crossing between scintillation crystals. Magnesium oxide holds the individual scintillation crystals together as a unit and acts as a highly reflective material to enhance the transmission of the signals. (Official Gazette)

32224 NUCLEAR IMAGING SYSTEM. Barrett, H. H.; Horrigan, F. A. (to Raytheon Co.). US Patent 3,825,757. 23 Jul 1974. Filed date 14 May 1973. 10p.

A nuclear imaging system for mapping the source of high-energy nuclear particles from a living organ which has selectively absorbed a radioactive compound by spatially coding the energy from the source in a Fresnel pattern on a detector and decoding the detector output to produce an image of the source is described. The coding is produced by a Fresnel zone plate interposed between the nuclear energy source and the detector whose position is adjustable with respect to the detector to focus the slices of the nuclear source on the detector. By adjusting the zone plate to a plurality of positions, data from a plurality of cross-sectional slices are produced from which a three-dimensional image of the nuclear source may be obtained. (Official Gazette)

32225 CRYOGENIC DEVICE FOR A LOW ENERGY X-RAY SPACE DETECTOR. Testard, O. A.; Leny, J.; Leszczyszyn, J.; Jehanno, C.; Cherpn, C.; Rothenflug, R.; Griffith, M. (CEN de Saclay, Gif-sur-Yvette, France). Cryogenics; 14: No. 9, 509-510(Sep 1974).

A cryostat was required for low energy x-ray studies in a space detector with no moving parts, or reacting jet of cryogenic fluid, and with an operating life of up to 10 hours. The design of such a cryostat in which every unavoidable thermal leak was reduced and a high enthalpy load was realized between 77 and 90 K is described. (auth)

32226 NUCLEAR RADIATION DETECTOR AND METHOD OF MANUFACTURING SAME. Kozlov, S. F.; Konorova, E. L. (to Ordena Levina Fizichesky Institut). US Patent 3,824,680. 23 Jul 1974. Filed date 8 Jul 1971. 6p.

A method of manufacturing a nuclear radiation detector comprising forming a plate from a diamond crystal whose thickness does not exceed the distance travelled by charge carriers within the plate under the influence of an applied field is described. The plate is then annealed in a vacuum at a temperature of 1,000° to 1,300°C whereafter blocking and injecting contacts are formed on opposite sides of the plate. During operation of the detector, polarization within the plate is removed by injection of charge carriers into the plate via the injecting contact, the latter being formed on the side of the plate opposite to that which is subjected to the radiation to be detected. (Official Gazette)

32227 EFFECTS OF PASSAGE OF IONIZING PARTICLES THROUGH A LIQUID CRYSTAL. Nagle, D. E. (Los Alamos Scientific Lab., NM); Doane, J. W.; Madey, R.; Saupe, A. Mol. Cryst. Liquid Cryst.; 26: No. 1-2, 71-74(1974).

Beams of ionizing particles may be detected by means of the temperature change induced in a cholesteric liquid crystal. Estimates indicate also that it may be possible to detect an individual heavy ion with a charge perhaps as low as 6 at all speeds and a singly-charged particle near the end of its range. (auth)

32228 NUCLEAR RADIATION MEASUREMENT. II. Description of an Industrial Unit. Marin, B. H. Elec.-Electron. Mod.; No. 280, 12-16(May 1974). (In French).

The exploitation of I. P. A. B. 71 is discussed in correlation with the NARDEUX S. A. probes which are used with it. (FR)

Radiation Dosimeters

Refer also to abstracts 31635 and 34037.

32229 (AED-CONF-73-482-008) LONG TERM CONSTANCY TEST OF IONIZATION DOSEMETERS USING THE ^{60}Co RADIOACTIVE DECAY. Rosenow, U.; Frischkorn, R. Goettingen Univ. (F. R. Germany. Frauenklinik und Poliklinik). 1973. 4p. (In German). (CONF-731089-2).

From 4th scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik; Homburg/Saar, F. R. Germany (4 Oct 1973).

A method is described which permits the longtime control of ionization chamber dosemeters. Deviations from the expected value are easily detected and long-term trends in the dosemeter sensitivity can also be confirmed. (GE)

32230 (ANL-8060(Pt.3), pp 120-126) TEMPERATURE SENSITIVE (TLD) FISH TAGS: IMPROVEMENTS IN TECHNIQUE. Romberg, G. P.; Prepejchal, W. 1973.

In Radiolological and Environmental Research Division annual report, January-December 1973.

Knowledge of the residence times of Lake Michigan fish at thermal discharges and the total temperature exposures they receive is necessary before data from laboratory studies on captive fish can be related to environmental conditions. Fish tagging studies using conventional identification tags can yield data on migration patterns and indicate residence time, but these tags can provide no information on temperature exposure. A temperature sensitive tag is needed to determine the length of time that free-swimming fish actually spend in the warmer water from thermal discharges entering Lake Michigan. Prompted by the obvious advantages of small size and low unit cost, a temperature sensitive tag was developed using pre-irradiated thermoluminescent dosimeters (TLD's). Use of $CaSO_4$:Mn in a Teflon matrix eliminated many of the problems encountered in 1972 when $CaSO_4$:Mn powder was used as the TLD material in fish tags. The TLD's used in the 1973 study were Teflon rods (approximately 10 mm long by 1 mm in diameter weighing 15 to 19 mg) which contained 4% $CaSO_4$:Mn by weight. The standard deviation for light output between rods was stated as 4% or less by the manufacturer. The inclusion of four rods in each tag provided replicate measurements and avoided the tedious and time consuming separation of TLD powder into similar sized subsamples. (auth)

32231 (BNWL-B-40) THERMOLUMINESCENT ENVIRONMENTAL DOSIMETER UTILIZING CaF_2:Dy. Nees, W. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Dec 1970. Contract AT(45-1)-1830. 9p. Dep. NTIS $4.00.

The TLD system consists of a plastic capsule, $\frac{1}{2}$ in. in diameter and $\frac{15}{16}$ in. in length. Inside the capsule is a double filter consisting of 350 mg/cm^2 of Pb and 435 mg/cm^2 Ta. The filters completely surround the three $\frac{1}{8}$ in. by $\frac{1}{8}$ in. by 0.35 in. TLD-200 blocks placed inside the capsule. The TLD-200 is readout on an Eberline Model TLR-5 reader. Annealing procedures, calibration, fading properties, and accuracy are briefly discussed. (WHK)

32232 (COO-2186-17, p 28) THERMOLUMINESCENT RESPONSE OF LITHIUM FLUORIDE TO HIGH RADIATION DOSES. Hutchinson, J. A.; Preiss, I. L. (Rensselaer Polytechnic Inst., Troy, NY). Jun 1974.

In annual report of the Nuclear Accelerator Laboratory, June 1, 1973–May 31, 1974.

32233 (IEA-312) INTERCOMPARISON BETWEEN PHOTOGRAPHIC, THERMOLUMINESCENT, AND RADIOPHOTOLUMINESCENT, AND RADIOPHOTOLUMINESCENT DOSIMETERS. Deus, S. F.; Watanabe, S. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Fisica do Estado Solido). Sep 1973. 23p. Dep. NTIS (US Sales Only) $4.25.

Comparison was made between the responses of three different dosimetric systems, namely, photographic, thermoluminescent (TL), and radiophotoluminescent (RPL) dosimetry. The comparison was divided into two parts. The first one was carried out with known radiation conditions (exposure, normal incidence, energy) in a controlled environment (−27°C temperature, ~70% relative humidity). Under these conditions, the response as a function of exposure and energy, the relation of the linearity to the energy, the lowest detectable exposure, and reproducibility were studied. The response as a function of exposure at 37 keV_{eff} and at 1 MeV was found to be linear in the region of interest to routine personnel dosimetry for all dosimeters except the films. Although the films response are not linear, the ratio between the response at 37 keV_{eff} and at 1 MeV does not depend on the exposure, and this allows the determination of a simple correction factor for the radiation energy. Such correction is usually necessary since all the dosimeters are strongly energy dependent, except the LiF TL dosimeters. We verified also that TL materials can detect lower exposures than other dosimeters. In the second part, the relative response of the dosimeters was measured under the uncontrolled condition in personnel dosimetry. Since the $CaSO_4$:Dy is the most sensitive dosimeter, comparisons were made using this dosimeter as the standard, in which case it was found that 20 out of 29 TLD-100 dosimeters gave the same reading within 30%, 13 out of 29 RPL dosimeters agreed within 30%, and only 3 out of 29 films fell within 30%. (auth)

32234 STABILITY OF FILM AND THERMOLUMINESCENCE DOSIMETERS IN WARM AND HUMID CLIMATES. Becker, K. (Oak Ridge National Lab., Tenn. (USA). Health Physics Div.). Atomkernenergie; 23: No. 4, 267-274(1974).

4 figs.; 6 tabs.; 49 refs.

With the increasing use of radiation sources in hot and/or humid climates, the long term stability of dosimeters selected for personnel, environmental, and postal intercomparison dosimetry is becoming a matter of world-wide concern. Laboratory tests with various film and TLDs are compared with the results of field tests, in particular a recent study involving the storage of different gamma monitoring films with or without additional protective sealing, LiF:Mg, Ti (TLD-100) and $CaSO_4$:Dy at seven locations in four Latin American countries. The observed fading rates range from 0 to 100% for the Kodak Type 2 and 3 films, and from 0 to 23% for the TLD phosphors, depending on the climate of the location. In four of the seven locations, unsealed films should not be used in x- and gamma-radiation personnel dosimetry (in two of those places, even optimum sealing did not prevent 54 to 89% fading). Extremes in storage temperature are more critical for TLD, extremes in relative humidity for the film fading. Apparently, even carefully sealed dosimeter films cannot be used in the climate prevailing at many locations in tropical and subtropical countries. (auth)

32235 NEUTRON AND GAMMA DOSE IN A T(d,n)-RADIATION FIELD: MEASUREMENT WITH A CALORIMETER. Weimer, G. (Giessen Univ. (F.R. Germany). 1. Physikalisches Inst.). Atomkernenergie; 23: No. 4, 261-266(1974). (In German).

4 figs.; 4 tabs.; 23 refs.

The construction and application of a calorimeter for the measurement of absorbed dose in a T(d,n)-radiation field is reported. The features of the calorimeter are interchangeable absorbers, small outer dimensions and easy handling. The sensitivity is 1×10^{-4}K (temperature difference) with a temperature drift of at least 2×10^{-6}K/s (corresponds to about 7 rd and 0.14 rd/s in graphite). The absorbed dose was measured in some plastics, metals and in graphite. The mixed neutron and gamma radiation field required a separation of the measured absorbed dose into the two components. For the nonmetallic absorbers two methods were used: the calculation of neutron kerma and an equation system using the dose values of two suitable absorber materials. These evaluations enabled the determination of the neutron kerma in the metals. Also the energy range of the contaminating gamma radiation forming the gamma dose could be indicated. (auth)

32236 AUTOMATIC ISODOSE PRINTER FOR STANDING FIELDS IN RADIOTHERAPY. Binder, W. (Vienna Univ. (Austria). Inst. fuer Klinische Strahlenbiologie). Strahlentherapie; 147: No. 5, 498-505(May 1974). (In German).

7 figs.

An automatically working isodose printer for the visualization of ionizing radiation fields by isodoses, necessary in radiotherapy of neoplasms, is described. The apparatus is usable for the measuring of stationary and non-stationary fields. Additionally, a water-phantom with automatic guide of the probe by remote control is described; the course of the probe can be of meandric form. A special electronic system was developed for the perception of the measuring signals and the printing of isodoses. Finally, some examples of printed isodoses of a ^{60}Co irradiation unit are demonstrated. (auth)

32237 A STUDY OF A GRAPHITE CAVITY CHAMBER FOR ABSOLUTE EXPOSURE MEASUREMENTS OF ^{60}Co GAMMA RAYS. Boutillon, M.; Niatel, M. T. (Institut National de la Sante et de la Recherche Medicale (INSERM), 75–Paris (France); Bureau International des Poids et Mesures, 92–Sevres (France)). Metrologia; 9: No. 4, 139-146(Dec 1973).

4 figs.; 5 tabs.; 26 refs.

The chamber is designed to allow the determination of the exposure to rely as far as possible on a theoretical analysis previously given by Allisy. As an extension of this analysis, the problem of the the influence of the cavity thickness is treated. The values to be used for the physical constants involved and the correction factors are discussed as well as the related uncertainties. (auth)

32238 ENVIRONMENTAL BACKGROUND BY CaSO4:Dy THERMOLUMINESCENT DOSIMETRY. Lariviere, P. D.; Ross, H. M. (Radiation Detection Co., Mountain View, CA). Health Phys.; 27: No. 2, 231-232(Aug 1974).

While studying the variability in the thermoluminescent response of $CaSO_4$:Dy powder samples, the environmental radiation background dose in a single story concrete building was measured over a period of 1 yr. This was found to be 113 mR observed and 135 mR corrected for fading. (UK)

32239 OPTIMUM INTEGRATING PERIOD FOR UNANNEALED LiF THERMOLUMINESCENT DOSIMETERS. Johnson, T. L. (Naval Research Lab., Washington, DC). Health Phys.; 27: No. 2, 220-222(Aug 1974).

A study is reported which shows that for minimum readout error of LiF thermoluminescent dosimeters due to fading the readout heating program and integration period should be chosen to include approximately 11% of the area of glow-peak 2, plus 60% of peak 3 and all of peaks 4 and 5. A method of approximately achieving this in practice is indicated. (UK)

32240 THERMOLUMINESCENT RESPONSE OF LiF DOSIMETERS TO FAST NEUTRONS PRODUCED WITH 25 TO 60-MeV

PROTONS ON THICK BERYLLIUM TARGET. Momeni, M. H. (Univ. of California, Davis). Health Phys.; 27: No. 2, 217-219 (Aug 1974).

An evaluation of the response of LiF dosimeters to neutron spectra above 15 MeV is reported. TLD-600, -700 and -100 (LiF) powders (Harshaw) were exposed to neutrons produced in a $^{9}Be(p,n)^{9}B$ reaction from a thick beryllium target. Glow curves of the dosimeters exposed to neutrons produced by 36 and 60 MeV incident protons are shown. The response of the dosimeters to equivalent γ exposures was determined with respect to the response of the dosimeters to ^{60}Co γ-irradiation and the results compared to those of Wingate et al. (Luminescence Dosimetry. p421. USAEC, Washington, D. C. (1967)). (UK)

32241 BERYLLIUM OXIDE DOPED WITH LITHIUM OR SODIUM FOR THERMOLUMINESCENCE DOSIMETRY. Yamashita, T.; Yasuno, Y.; Ikedo, M. (Matsushita Electric Industrial Co. Ltd., Kadoma, Osaka, Japan). Health Phys.; 27: No. 2, 201-206(Aug 1974).

Lithium or sodium doped beryllium oxide, BeO(Li: 0.5 mol %) and BeO(Na: 0.5 mol %), was found to be efficient and reliable thermoluminescent phosphors. Glow curves of both BeO(Li) and BeO(Na) have simple peaks at 180°C. The thermoluminescent spectrum shows a broad band in the ultraviolet region peaking at 330 mμ with shoulders near 300 and 390 mμ. Besides featuring the characteristic that this material has a photoelectric absorption equivalent to that of biological tissue, the main characteristics of the phosphors, from the point of view of dosimetry include: (1) Exposure response of BeO(Li) is linear from 1 mR to 500 R, and that of BeO(Na) is linear from 2 mR to 100 R. (2) Fading of BeO(Li) is less than 20% within the first hour and 8% within the following 30 days, and that of BeO(Na) is less than 10% within the first hour and 5% within the following 30 days. Light fading of γ-ray exposed BeO(Li) and BeO(Na) is less than 10% for a light exposure of 300 lux for 10 min. (3) After repeated use, easy annealing (heating at 450 ~ 500°C for 1 ~ 10 min) removes the residual dose. (4) The thermoluminescent efficiency remains unchanged after more than 100 cycles of repeated exposure-readout operations. (5) A small amount of tribothermoluminescence is emittable; about 15 mR dose equivalent for dropping 10 times from a height of 1 m to concrete floor. (auth)

32242 GLASS AS A RADIATION DETECTOR (APPROXIMATELY 10^{3} RADS). Mafra, O. Y. (Instituto de Energia Atomica, Sao Paulo, Brazil); Renner, C.; Goldenberg, J. Radiat. Eff.; 21: No. 1, 61-64(1974).

Glass plates have been developed as high exposure dosimeters. They can be utilized in measuring absorbed dose in the range about 10^{9} and 10^{10} rads. The principle of operation is based on the relationship between the absorbed dose and the increased loss of mass from the glass surface when it is etched in a 6% HF solution from 5 to 50 minutes. The advantages of the technique are the low price of the dosimeter, reproducibility and possibility of working with a dose that saturates other dosimeters. (auth)

32243 USE OF ^{231}Pa AND ^{236}U IN MEASURING FAST NEUTRON SPECTRA. Koshaeva, K. K.; Kraitor, S. N. Sov. At. Energy (Engl. Transl.); 34: No. 1, 66-68(Jan 1973).

Translated from At. Energ. (USSR); 34: No. 1, 49-52(Jan 1973).

The use of ^{231}Pa and ^{236}U in a threshold detector system for measuring neutron spectra in the 0.5 to 1.5 MeV range is discussed. It is seen that the inclusion of ^{231}Pa and ^{236}U in the set of detectors permit a decrease of three to four times in the error of measuring spectra in the 0.5 to 1.5 MeV range. (WHK)

32244 THE CHECKING OF THE LONG-TERM CONSTANCY OF AN IONIZATION-DOSIMETER ON THE RADIOACTIVE DECAY OF ^{60}Co. Rosenow, U.; Frischkorn, R. (Goettingen Univ. (F. R. Germany). Strahlenabteilung). Strahlentherapie; 147: No. 6, 619-623(Jun 1974). (In German).

From fourth scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Homburg/Saar, F. R. Germany (4 Oct 1973). 2 figs.; 1 tab. Also published as AED-CONF-73-482-008.

A method is described which permits the longtime control of ionization chamber dosemeters. Deviations from the expected value are easily detected and long-term trends in the dosemeter sensitivity can also be confirmed. (GE)

32245 DOSIMETRIE UND STRAHLENSCHUTZ. Physikalisch-Technische Daten und Methoden fuer die Praxis. (Dosimetry and Radiation Protection. Physical and Technical Data and Methods for Practical Use). Jaeger, R. G.; Huebner, W. (eds.). Stuttgart, F. R. Germany; Thieme (1974). 479p. (In German).

With refs.; 193 figs.; 173 tabs.

Following a general introduction into atomic structure and radioactivity, the present newly revised issue deals with radiation field values and units, dose values and dose units, corpuscular, gamma and X-rays and all problems in dosimetry and radiation protection associated with these types of radiation. (GE)

32246 DISCUSSION ON DOSIMETRY AND COLLIMATION OF FAST-NEUTRON BEAMS. Eur. J. Cancer; 10: No. 5, 313-332(May 1974).

From second meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

The physical aspects of the dosimetry of fast neutron beams used in therapy, the dependence of the biological response on depth in tissue and neutron dose fractionation procedures, and the collimation and shielding of fast neutron beams are described. The discussion represents 21 separate short papers presented at the conference by authors from various centers in Europe and U.S.A. (UK)

32247 NOVEL POLYSTYRENE PRODUCT HAVING RAPID-POST-IRRADIATION DECAY OF CONDUCTIVITY AND PROCESS OF MAKING SAME. Parkinson, W. W. Jr.; Kelly, M. J.; Sturm, B. J.; Martin, W. J. (to United States Atomic Energy Commission). US Patent 3,835,122. 10 Sep 1974. Filed date 25 Apr 1973. 6p.

A method for fabricating a thin film plastic insulator for use as the dielectric in the capacitor of a quartz fiber ionization dosimeter is described. The film is specially designed to suppress post-irradiation conductivity to prevent error in the dosimeter reading. (WHK)

32248 INVESTIGATIONS ON THE FERROUS SULFATE AND FERROUS SULFATE-CUPRIC SULFATE DOSIMETERS. Aasard, P. E.; Nilsson, B.; Eriksson, L. (Karolinska Sjukhuset, Stockholm). Acta Radiol., Suppl.; No. 310, 29-38(1971).

Special plastic containers for ferrous sulphate dosimetry have been designed. The factors which might affect the $G(Fe^{3+})$-values for ferrous sulphate and ferrous suphatecupric sulphate solutions stored in plastic containers have been investigated for different plastic materials. The variation of the $G(Fe^{3+})$-value seems mainly to depend on impurities on the contact surfaces. (auth)

32249 TEMPERATURE RESPONSE OF SILICON SURFACE BARRIER SEMICONDUCTOR DETECTORS OPERATED IN THE DC-SHORT CIRCUIT CONFIGURATION. Klevenhagen, S. C. (London Hospital). Acta Radiol., Ther., Phys., Biol.; 12: No. 2, 124-144(1973).

The response to temperature of silicon p-n junction surface barrier devices used as dosemeters in dc-short circuit mode of operation was investigated, and an analysis of their performance in a temperature compensated circuit made. It was found that detectors of both planar and cylindrical geometry have similar temperature characteristic and it was shown that there are three contributors to the temperature effect, i.e., the variations in the radiation generated current and changes in the thermal current and in the internal impedance of the p-n junction. Their behavior and contribution were studied. The p-n junction detectors can have both positive and negative temperature coefficient, an effect not very clearly explicable by the theory of the n-p junction. The detectors showing an increase of current with increasing temperature qualify for operation in the compensated external circuit and are therefore useful for application in clinical measurement. (auth)

32250 DEVICE FOR CONTROLLING THE HEATING OF THERMOLUMINESCENT DETECTORS ACCORDING TO A LINEAR LAW. Kharitonov, V. G.; Shaks, A. I.; Lebedev, E. L.; Trifonov, V. A. (Biophysics Inst., Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 1, 168-170(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 1, 150-152(1974).

A circuit has been developed for programmed heating of thermoluminescent detectors. The circuit ensures linear growth of the temperature of the heater rated at a power of approximately 450 W in the range from 50 to 350°C at heating rates ranging from 1 to 10°C/sec. (auth)

32251 METHOD OF MEASURING FAST NEUTRON FLUX USING THERMOLUMINESCENT DOSIMETER. Moran, P. R.; Pearson, D. W. (to United States Atomic Energy Commission). US Patent 3,835,329. 10 Sep 1974. Filed date 23 Aug 1973. 12p.

Thermoluminescent phosphors which are susceptible to neutron activation are exposed to a mixed field of radiation. Thermoluminescence resulting from prompt gamma irradiation is removed by a short period of annealing at a high temperature. The phosphors are then stored in a shielded chamber maintained at a suf-

ficiently low temperature to allow accumulation of radiation dose produced by radionuclides formed on neutron activation. The thermoluminescence attributable to this self-irradiation dose is read and correlated to neutron flux or dose. Through use of separate phosphor materials having different threshold energies for neutron activation, energy spectra of fast neutron flux is obtained. (Official Gazette)

Nuclear Spectroscopic Instrumentation

32252 (CONF-730536-3) SOFTWARE DEVELOPED FOR THE RADIATION COUNTING LABORATORY AT THE NASA MANNED SPACECRAFT CENTER. Davies, R. C. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). 1973. 10p. Dep. NTIS $4.00.

From DECUS spring symposium; Philadelphia, Pennsylvania, USA (2 May 1973).

A background/foreground data acquisition and analysis system incorporating a "high level" control language has been developed for the Radiation Counting Laboratory at the NASA Manned Spacecraft Center. The system supports acquisition of gamma-ray spectra in a 256 × 256 coincidence matrix (utilizing disk storage) and simultaneous operation of any of several background support and data analysis functions. In addition to special instruments and interfaces, the hardware consists of a PDP-9 with 24K core memory, 256K words of disk storage, and DECtape and Magtape bulk storage. (auth)

32253 (KFK-1994) A PROTON RECOIL SPECTROMETER FOR IN-PILE-MEASUREMENTS IN THE ENERGY RANGE BETWEEN 500 keV AND 3 MeV. Korthaus, E. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Jun 1974. 24p. (In German). INIS.

12 figs.; 9 refs. With abstract in German and English.

A proton recoil spectrometer for in-pile-measurements of neutron spectra between 500 keV and 3 MeV in fast zero energy assemblies is presented. It uses a spherical ionization chamber filled with methane at 11 atmospheres and works at a high voltage of 12 kV. Test measurements with monoenergetic neutrons have revealed an energy resolution of 10%. Results of measurements on a ^{252}Cf-spontaneous fission neutron source and a ^{241}Am/F-(α,n)-source as well as measurements in the SUAK assembly 7A are in good agreement with results of other authors. (auth)

32254 (USNDC-11, pp 68-69; 95-102) BIAS IN FISSION FRAGMENT DETECTION USING IONIZATION CHAMBERS. Cohensedgh, F.; Felvinci, J. P.; Melkonian, E. (Columbia Univ., New York). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

32255 METHOD FOR ESTABLISHING EFFECTIVE NEUTRON ENERGY AND FLUENCE IN MIXED RADIATION FIELDS. Engelke, M. J.; Israel, H. I. (Los Alamos Scientific Lab., NM). Health Phys.; 27: No. 2, 173-179(Aug 1974).

A neutron dosimeter has been developed that is a completely passive device intended for measurements of neutron fluence and effective neutron energy in mixed radiation fields of photons and neutrons. This application makes use of measurements by thermal neutron detectors on the surface and at the center of a polyethylene sphere. The ratio between the surface and center responses is a function of the incident neutron energy. A simplified means is provided for interpreting the results in terms of neutron fluence, effective neutron energy and biological dose. Calculations have been made using an adjoint neutron transport code, for 8, 10, 12 and 18 in. diameter polyethylene spheres. Experimental data and theoretical calculations agree within a factor of two. (auth)

32256 SCIENTIFIC EQUIPMENT FOR STUDYING COSMIC RAYS ON PROGNOZ SATELLITES. II. Volodichev, N. N.; Vorob'ev, A. I.; Grigorov, N. L.; Kolesov, G. Ya.; Kudryavtsev, M. I.; Likin, O. B. (Inst. of Space Research, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 5, 679-683(1973).

Translated from Geomagn. Aeron.; 13: No. 5, 801-806(1973).

The scientific instruments installed on the Prognoz and Prognoz-2 unmanned stations for studying electron, x-ray, and γ-radiation fluxes are described. Methods of transmitting the information by telemetry are examined. (auth)

32257 LOW-ENERGY ELECTRON AND PROTON SPECTROMETER ON THE MOLNIYA-1 SATELLITE. Lazarev, V. I.; Mar'in, B. V.; Tel'tsov, M. V.; Shilov, V. V. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 5, 684-687(1973).

Translated from Geomagn. Aeron.; 13: No. 5, 807-811(1973).

The operating principle and the electric circuit of the spectrometer for recording electrons and protons with energies 1 to 20 keV on board Molniya 1 are described. Particles of a certain energy are separated by a cylindrical-type electrostatic analyzer and detected by a channel electron multiplier (CEM). The dynamic range of operation of the instrument is 10^4 to 10^8 particles·cm^2·sec^{-1}·sterad^{-1}·keV^{-1} for a particle energy of 1 keV and $1.6 \cdot 10^3$ to $1.6 \cdot 10^7$ particles·cm^2·sec^{-1}·sterad^{-1}·keV^{-1} for a particle energy of 20 keV. (auth)

32258 EKSPERIMENTAL'NYE ISSLEDOVANIYA POLEI GAMMA-IZLUCHENIYA I NEITRONOV. (Experimental Study of Gamma-Radiation and Neutron Fields). Egorov, Yu. A. (ed.). Moscow; Atomizdat (1974). 392p.

The methods and apparatus for the registration and processing of the results of measurements of neutron and γ radiation close to the different radiation sources are described. On the basis of the results of original studies by the authors, the possibilities of the use of computer techniques in these experiments are shown. The measurement errors are analyzed. The methods for the determination of the efficiency of the registration of the radiation are examined. Methods for the study of the energy and spatial distribution of neutrons and γ quanta (including the spectrometry of one form of radiation in the background of the other) are described. The characteristics of the devices used are reported. (tr-auth)

32259 PRIKLADNAYA SPEKTROMETRIYA S POLUPROVODNIKOVYMI DETEKTORAMI. (Applied Spectrometry With Semiconductor Detectors). Baldin, S. A.; Vartanov, N. A.; Erykhailov, Yu. V.; Ioannesyants, L. M.; Matveev, V. V.; Sel'dyakov, Yu. P. Moscow; Atomizdat (1974). 320p.

The basic physical processes for the registration of ionizing radiation with semiconductor detectors with electron-hole transitions and the methods and practical procedures for their spectrometry are described. The characteristics of use of semiconductor detectors, their types, and the basic parameters and characteristics are examined. Methods are given for the calculation and construction of electronic devices necessary for the transmission and preliminary processing of the electrical signal from the detectors. Questions on the forming of the spectrogram, factors affecting the form of the spectrogram, selection of the type of detector, construction of the elements of detection units, and principles for the construction of spectrometers are discussed in detail. The most promising types of energy spectrometers for the principal forms of ionizing radiation (heavy charged particles, γ and neutron radiation, β particles, and x-radiation) and the characteristics of their use in the solution of different scientific and technical problems are described. (tr-auth)

32260 POSITRON ANNIHILATION IN Ge(Li) DETECTOR FROM LINE SHAPE OF SINGLE-ESCAPE PEAK. Ljubicic, A. (Univ. of Ottawa); Carter, A. L.; Clarke, R. L. Phys. Rev., B; 10: No. 1, 31-35(1 Jul 1974).

The line shape of the single-escape peak of high-energy γ rays has been investigated. A 30-cc Ge(Li) detector was irradiated with 2614.5 and 2753.9-keV γ rays from ^{208}Tl and ^{24}Na, respectively. The observed broadening of the single-escape peaks was attributed to the Doppler shift of annihilation radiation, and, by unfolding the instrumental resolution the momentum distribution of the electrons in a germanium crystal was deduced. In addition, an upper limt of 5.4×10^{-3} for the ratio of the probabilities for positron annihilation with a K-shell electron to that with an electron from other atomic shells was determined. (auth)

32261 SHAPE OF THE LINE OF SEMICONDUCTOR SPECTROMETERS FOR IONIZING RADIATIONS. Volkov, N. G.; Pyatkov, Yu. V. (Moscow Engineering-Physics Inst.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 1, 285-286(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 1, 245(1974).

An attempt to clarify the character of the deviations of the shape of the lines of a semiconductor spectrometer from the Gaussian shape and to analyze the errors associated with this is described. (WHK)

High Energy Physics Instrumentation

Refer also to abstracts 33639 and 34052.

32262 (ANL/HEP-7215) SUPERCONDUCTING MAGNET FOR THE 15 FOOT NAL BUBBLE CHAMBER. Purcell, J.; Desportes, H.; Jones, D. (Argonne National Lab., Ill. (USA)). Feb 1973. 59p. Dep. NTIS $6.00.

Specifications for the superconducting magnet for the 30,000 liter bubble chamber to be delivered by ANL are given. (WHK)

32263 (BNL-19116) VERTEX SPECTROMETER OF THE MULTIPARTICLE ARGO SPECTROMETER SYSTEM AT BNL. Schuebelin, P.; Ramanauskas, A.; Turkot, F.; Collins, G. B.; Ficenec, J. R.; Gilbert, D. R.; Schreiner, W. N.; Stringfellow,

B. C.; Trower, W. P. (Brookhaven National Lab., Upton, N. Y. (USA)). 1973. 20p. (CONF-730976-5). Dep. NTIS $4.00.

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (1 Sep 1973).

The need for definitive studies of high multiplicity, high momentum transfer reactions in the 30 GeV energy range prompted the design and construction of a Vertex Spectrometer (VS) which combined the large solid angle advantage of a bubble chamber with the triggerability and digitized readout capability of an electronic system. The detector has been used as an integral part of the Multiparticle Argo Spectrometer System (MASS) at Brookhaven in an experiment which studied pp interactions at 28.5 GeV/c. The VS consists of a nested set of 9 cylindrical wire spark chambers surrounding a 20 cm long hydrogen target located in a ten kG magnetic field. The field volume measures $1.5 \times 1 \times 1$ m^3. The chambers have radii varying from 15 cm to 47 cm with an active height of 74 cm. The axis of the cylinders is perpendicular to the beam. Dip angles of ±50° with respect to the beam are covered. High multiparticle efficiency is accomplished by pulsing the chambers in a transmission line mode. Digitization is obtained by means of magnetostrictive lines located inside the magnet and shielded from the ten kG field. (WHK)

32264 (KFTI-73-26, pp 70-71) TOTAL-ABSORPTION CHERENKOV SPECTROMETER. Shramenko, B. I.; Krinitsyn, A. N.; Grishaev, I. A. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In Nuclear Science and Engineering Problems. Ser. High energy physics and nuclear physics.

The development of a Cherenkov shower (burst) spectrometer having complete absorption with a radiator in the form of an accelerator cone from a KRS-6 monocrystal is described. The radiator is in optical contact with a photomultiplier. For amplitude analysis an AI-128-2 analyzer was used. The spectrometer was calibrated on linear accelerator electron beams in the energy range 150 to 1270 MeV. The calibrated properties and the energy dispersion of the spectrometer are presented as a function of the beam energy. (INIS)

32265 (N-74-17526) SECONDARY ELECTRON BACKGROUND PRODUCED BY HEAVY NUCLEI IN A MULTIWIRE PROPORTIONAL COUNTER HODOSCOPE. Morgan, S. H. Jr.; Watts, J. W. Jr.; Schwille, H.; Pollvogt, U. (National Aeronautics and Space Administration, Huntsville, Ala. (USA). George C. Marshall Space Flight Center). Feb 1974. 48p. (NASA-TN-D-7591; M-462). NTIS $0.25.

The secondary electron background produced by heavy nuclei in a multiwire proportional counter hodoscope is calculated using both a simplified and a more complete Monte Carlo model. These results are compared with experimental data from a small multiwire proportional counter hodoscope operated in a 530 MeV/nucleon accelerator beam of nitrogen nuclei. Estimates of the secondary electron background produced by heavy relativistic nuclei are presented along with the detailed results from calculations of energy deposition in the hodoscope counter cells. (auth)

32266 (RL-74-019) PRELIMINARY RESULTS ON THE CHARACTERISTICS OF A MULTIWIRE PROPORTIONAL CHAMBER WITH 1 mm WIRE SPACING. Blissett, J. A.; Broome, T. A.; Hart, J. C.; Mallary, M. L.; Middlemas, N.; Parham, A. G.; Payne, B. T.; Sanford, T. W. L.; Walker, T. G. (Science Research Council, Chilton (UK). Rutherford Lab.). Jan 1974. 28p. Dep. NTIS (US Sales Only) $4.50.

A MWPC system has been designed and one 1 mm pitch plane has been thoroughly tested. Preliminary results indicate that the system parameters are reasonably optimized and that the plane shows a sustained stable operation and exhibits a wide plateau at full efficiency with low noise. Details are presented of the mechanical and electrical design, and the performance of the instrument. (UK)

32267 (RL-74-069) CRYSTAL OPERATORS' GUIDE. Chapman, W. S.; Bairstow, R.; Hatley, R. (Science Research Council, Chilton (UK). Rutherford Lab.). Apr 1974. 32p. Dep. NTIS (US Sales Only) $4.75.

The report describes the procedures that must be carried out to use the CRYSTAL film measurement system (for analyzing the particle tracks recorded from a bubble chamber), the commands available to the operator, and the messages the computer sends to the operator. (auth)

32268 (RL-74-080) METHOD OF TESTING MULTIWIRE PROPORTIONAL CHAMBERS BY GLOW DISCHARGE/PHOTOGRAPHIC TECHNIQUES. Marsh, J. B.; Boon, J. E.; Souten, K. H.; O'Hagan, B. (Science Research Council, Chilton (UK). Rutherford Lab.). May 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

It is stated that a method of testing was evolved principally to identify faults, quickly and positively, on large chambers at the end of their manufacture. Dry nitrogen of high purity was found to have advantages over an air discharge. Photographs were taken, and examples are shown of typical faults and of the effect of cleaning the wires. Interplane accuracy is also discussed. The performance was checked by exposing the chamber to a 2 mC source of ruthenium-103 at grid reference points and noting the change in overall chamber current at each point. (UK)

32269 CONTINUOUS DETERMINATION OF INSTRUMENTAL VARIATIONS FOR MUON TELESCOPES. Blokh, Ya. L.; Libin, I. Ya. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 5, 688-692(1973).

Translated from Geomagn. Aeron.; 13: No. 5, 812-817(1973).

A method is proposed for continuously determining instrumental variations for a muon telescope. It permits continuously introducing corrections into cosmic-ray intensity data with high statistical accuracy. A block diagram of the device for determining instrumental variations is presented. (auth)

32270 NEW TYPE OF CRYSTAL SPECTROMETER FOR SOLAR X-RAY STUDIES. Catura, R. C.; Joki, E. G.; Bakke, J. C.; Rapley, C. G.; Culhane, J. L. (Lockheed Missiles and Space Co., Palo Alto, CA). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 217-220(Jul 1974).

A new type of crystal spectrometer for the study of the solar x-ray spectrum is described. Previous solar x-ray crystal spectrometers have required a scanning mechanism to move both the crystal and the detector so that the required range of wavelengths may be covered. By employing a crystal bent in the plane of dispersion, a range of wavelengths may be studied simultaneously by registering the dispersed spectrum with a position sensitive X-ray detector. Details of the instrument are presented together with some solar X-ray data obtained in an early flight of the device. (auth)

32271 CIRCUIT DESIGNED TO DISCARD TWO OR MORE THAN TWO EVENTS DETECTED BY HODOSCOPE COUNTERS. Upadhyay, P. N. (Gaya Coll., India). Indian J. Pure Appl. Phys.; 11: No. 11, 858-859(Nov 1973).

A fast electronic circuit, designed to reject two or more than two particles detected by the hodoscope counters is described. The circuit is efficient in the detection of pions released in nuclear reactions and thus helps to calculate the missing mass of M-mesons in π^-p interactions. (auth)

Radiometric Instruments

Refer also to abstracts 31962, 32350, 32352, and 32353.

32272 (CONF-740655-, pp P5p1-2) CIGARETTE WEIGHT CONTROL AND THE FUTURE. Hanekom, N. W. 1974.

From conference on nuclear technology; Cape Town, South Africa (Jun 1974).

The filling or weight of individual cigarettes has to be monitored continuously in the cigarette manufacturing industry. The use of a gage which uses the absorption of beta rays from a radioactive strontium-90 source is described. (auth)

32273 (CONF-740655-, pp P6p1-6) FILL-LEVEL INSPECTION REJECTION SYSTEM. Lindsay, N. B. (Ohlsson's Cape Breweries, Cape Town). 1974.

From conference on nuclear technology; Cape Town, South Africa (Jun 1974).

A nucleonic system for the measurement of the fill level of individual containers of beer on a process conveyor is described. The absorption of caesium-137 gamma rays is employed to control the action of an ejection mechanism. (auth)

32274 (CONF-740655-, pp P7p1-2) USE OF ISOTOPES IN CONSTRUCTIONAL ENGINEERING. Lourens, J. (Plessey South Africa Ltd., Cape Town). 1974.

From conference on nuclear technology; Cape Town, South Africa (Jun 1974).

A nucleonic instrument, the hydrodensimeter, has been developed in South Africa for the in situ determination of density and moisture content of soil. Cesium-137 is used for density measurement with the gamma-backscatter method, while americium/beryllium is used as source of neutrons for the determination of hydrogen, i.e., in water. (auth)

32275 STOCHASTIC MODEL OF RADIOMETRIC GRADING AND SORTING OF URANIUM ORES. Hejtman, J. (Development Plant of the Czechoslovak Uranium Industry, Kamenna). Rudy (Prague); 21: No. 8, 249-252(Aug 1973). (In Czech).

A theoretical model of radiometric separation of uranium ores

is presented as was developed by the Development Plant of the Czechoslovak Uranium Industry at Kamenna. A relation is formulated between the probability of collecting grains of standard equivalent E_m (mgs of uranium in standard) for the enriched product and the radiometric switching level I_1 (imp. s^{-1}), depending on the parameters of the separator, the parameters of the separated ores, and the hour output of the radiometric separator. A program was written in the ALGOL-60 language for the ODRA-1204 computer. Computed distribution curves are presented for ores of mean metallic content of 100 units and contrast ratios of M = 1.2 and 1.8, and for ores of mean metallic content of 1000 units and a contrast ratio of M = 1.8. The curves also show the effect of the hour output of the separator. (Nuclear Sci. Abstr. Czeck.)

32276 IONIZATION CHAMBER WITH A POROUS ANODE. Lupton, J. D. US Patent 3,828,184. 6 Aug 1974. Filed date 8 Mar 1972. 6p.

An ionization detector analyzes a flowing fluid stream for a specific gas or gases. The recirculation of gases between electrodes is eliminated, and the gas between the anode and cathode is not restrained. The anode is made of a porous, electrically conductive material and the cathode is a beta emitting foil positioned adjacent to, but physically and electrically isolated from, the anode. The detector will function with or without an added cell voltage. The response of the detector to the water of aqueous solutions is so limited in duration that a characteristic response from organic substances can be obtained even when the substance is introduced in an aqueous solution to the chromatographic column. (Official Gazette)

32277 DETECTOR ASSEMBLY. Dahlin, E. B.; Hill, R. C. (to Measurex Corp.). US Patent 3,828,190. 6 Aug 1974. Filed date 23 Sep 1971. 8p.

A detector assembly is described for detecting radiation which has been directed at a sheet of material which has a honeycomb structure for collimating the radiation to thereby minimize sensitivity of the detector assembly to the position of the sheet relative to the detector assembly. The detector may be used with a radiation source for measuring density, thickness, or moisture content of sheets. (Official Gazette)

32278 IONIZATION SMOKE DETECTOR. Kobayashi, A.; Tagashira, H.; Takahashi, N. Czech Patent 147,649. 23 Apr 1972. 4p. (In Czech).

An ionization smoke detector is proposed consisting of a closed and an open ionization chamber connected in series; each is provided with a pair of electrodes and a radioactive source and an FET transistor. The transistor converts the changes in the open ionization chamber impedance resulting from the increase in the amount of smoke, to current or voltage signal changes. The detector sensitivity can also be controlled by the change in the length and/or the thickness of the electrode, thus changing the characteristics of the open ionization chamber. (INIS)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to abstract 31981.

32279 (AD-778811) TRANSIENT RADIATION EFFECTS. Interim Summary Report, 11 June–31 December 1973. Berger, R. A.; Colwell, J. F.; Fisher, C. J.; Flanagan, T. M.; Green, B. A. (Intelcom Rad Tech, San Diego, Calif. (USA)). 30 Nov 1973. Contract DAAG39-73-C-0197. 77p. (RT-8008-003). NTIS $3.75.

Topics include displacement damage in compound semiconductors; transient conductivity in counterdoped silicon; electric contacts; charge transport and trapping in MOS structures; measurement of charge carrier lifetimes; and charge storage in polymeric insulators. (GRA)

32280 (AD-911497) EFFECTS OF IONIZING RADIATION ON TANTALUM CAPACITORS. Final Report. Flanagan, T. (Gulf Radiation Technology, San Diego, Calif. (USA)). 30 Mar 1973. 118p. (GULF-RT-C-12566). NTIS $9.00.

Maverick radiation response in capacitors is caused by charge injection and storage within the oxide. While there are always sufficient traps to store charge in the oxide, for most capacitors significant injection of charge does not occur at the electrodes when bias of the correct polarity is applied. In a few capacitors, one or both electrodes do not block adequately and charge can be injected and trapped in the TA205. Ionizing radiation releases this trapped charge, and the charge can then move under the influence of the built in bias plus the space charge field producing an anomalously large zero-bias radiation transient. Capacitors which can readily store charge can be eliminated from the population by application of the appropriate electrical screen. Once a population has been screened, indications are that the introduction rate of maverick capacitors under normal use conditions, including a screening dose of radiation, is about the same as the failure rate due to aging. (GRA)

32281 (KFTI-73-26, pp 79-81) PARAMETER VARIATION OF CHANNEL STRUCTURES BY ELECTRON IRRADIATION. Antipenko, A. P.; Nosov, V. M.; Ryabka, P. M.; Skubko, V. A.; Kheifets, M. I. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High physics and nuclear physics.

The effect of radiation defects produced in a semiconductor lattice on the properties of channel structures in field effect transistors was studied. The transistors were irradiated with 30-MeV electrons. The change in properties was evaluated from the deformation of the volt-ampere characteristics and the rupture tension. The dependence of the current change and the rupture tension on the radiation dose was determined experimentally. The transistors were irradiated without load and under load in a direct and inverse connection. In the latter case the rupture tension was always greater for the inclusion tension than for the current passage tension during the irradiation. (INIS)

32282 (KFTI-73-26, pp 82-84) SPECIFIC FEATURES OF CURRENT-VOLTAGE CHARACTERISTICS DEFORMATION OF SOME TYPES OF CHANNEL STRUCTURES BY FAST ELECTRON IRRADIATION. Antipenko, A. P.; Nosov, V. M.; Ryabka, P. M.; Skubko, V. A.; Kheifets, M. I. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

The results are reported of studies on the change in volt-ampere properties of unipolar transistors irradiated with 30-MeV electrons. With sufficiently large doses of radiation and definite values of the potential between the output and the source, there is a typical curve showing the field of negative differential resistance. The reverse course of the volt-ampere properties does not coincide with the first so that there is a loop hysteresis. The dynamics of excitation and development of the loop are discussed for some of the volt-ampere characteristics as a result of irradiation at doses of 10^{16} to 7×10^{14} e/cm^2. The time changes in the loop after a specified radiation dose were determined. (INIS)

32283 ELECTRON AND NEUTRON DAMAGE IN N- AND P-CHANNEL JUNCTION FIELD EFFECT TRANSISTORS. Miller, D. J.; Ryan, R. D. (Australian Atomic Energy Commission Research Establishment, Sutherland). Radiat. Eff.; 21: No. 2, 99-104(1974).

The electrical properties of Si n- and p-channel junction field effect transistors (JFET's) were measured after irradiation with fast neutrons and 1 MeV electrons, before and after annealing up to 675 K. A pulse technique was used to measure the energy levels of the radiation defects. It was found that one of the defects in the n-channel JFET's had an energy level at approximately $E_C - 0.4$ eV and, in the case of electron damage, annealed sharply at about 425 K. These properties suggest that the defect is the Si-E centre. The energy level of the major source of damage in the p-channel JFET's could not be measured by the techniques used but the annealing temperature of 600 to 675 K agreed with that of the Si-K centre. Considerable recovery in properties of the neutron damaged p-channel devices can be achieved by forward biasing the gate at room temperature. (auth)

32284 ELECTRICAL ACTIVITY OF NEUTRON DAMAGE CENTRES IN SILICON DIODES. Morgan, D. V.; Ashburn, P. (Univ. of Leeds, Eng.). Radiat. Eff.; 22: No. 1, 35-38(May 1974).

A study is made of radiation damage in silicon p$^+$n diodes produced by low dose neutron irradiation, and a comparison is made with the results of earlier work on carbon irradiated diodes. Particular emphasis is placed on the effects of damage on the I/V characteristics of the diodes. The physical properties of the damage are studied by means of thermally stimulated current measurements, and further information is obtained from the temperature dependence of the reverse leakage. (auth)

32285 DAMAGE EFFECTS IN SILICON SURFACE BARRIER DETECTORS WITH 0.5 TO 2 MeV PROTONS. Nakamoto, S. (Chubu Inst. of Tech., Kasugai, Aichi, Japan); Aoki, T.; Kawabata, K.; Norisawa, K.; Sakisaka, M. Jap. J. Appl. Phys.; 13: No. 3, 524-528(Mar 1974).

Silicon surface barrier detectors have been irradiated with

0.5 to 2 MeV protons to observe the radiation damage effects appearing in electrical properties. The depletion layer capacitance against bias voltage has shown a plateau which is dependent on proton fluence and energy. This behavior is consistently explained by the proposed model in which the induced defects act as acceptors and compensate donor ions in the proton range. The effective number of defects is estimated to be about 0.2 per 1 MeV proton. (auth)

Miscellaneous Instruments

Refer also to abstracts 32006, 32042, 32306, 33771, and 34227.

32286 (ANL-8060(Pt.3), pp 152-155) DEVELOPMENTS IN RADIOTELEMETRY OF FISH AT THERMAL DISCHARGES. Prepejchal, W.; Van Loon, L. S. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

A radiotelemetry system was developed that would allow continuous monitoring of fish movements in and near thermal plumes and insure maximum flexibility in terms of multiparameter transmission. The selection of a suitable radiofrequency of fish tracking involves many trade-offs. Transmitted power is low because of the restrictions in the total weight and size of the transmitter; therefore, a highly efficient portable receiver antenna system for use in boats was necessary. (CH)

32287 (CEA-BIB-209(Suppl.1)(Add.1)) BIBLIOGRAPHIC STUDY ON THE WINDOWLESS CONTINUOUS CHANNEL ELECTRON MULTIPLIERS, RESEARCH AND DEVELOPMENT. Bornand, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). Jul 1974. 8p. (In French and English). Dep. NTIS (US Sales Only) $4.00.

Thirty-four bibliographic references with abstracts translated in French are presented. This addendum is made from abstract reviews (EEA and NSA), issued from July 1973 to June 1974. (auth)

32288 (CONF-730618-, pp 226-231) FISSION FRAGMENTS SEPARATION ACCORDING TO MASS, ENERGY, AND EFFECTIVE CHARGE IN ELECTRICAL AND MAGNETIC FIELDS. Arifov, U. A.; Belyaev, A. D.; Kogan, V. I.; Pikul, V. P.; Usmandiarov, A. M.; Kosilov, V. A.; Petrov, N. V. (Inst. of Electronics, Tashkent). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A mass spectrometer located in a reactor neutron beam has been designed and constructed for the separation of fission fragments according to their mass, energy and effective charge. A thin layer of ^{235}U located in a high neutron flux serves as a source of fragments. The fission fragments at their initial energy pass through the electrostatic field of a cylindrical condenser, (with a deflection radius r_{eo} = 274.1 cm, deflection angle Φ_e = 19°7') and a sectoral uniform magnetic field (with a deflection radius r_{mo} = 177.5 cm, deflection angle Φ_m = 40°) which are located in series, and then focused at a distance of 227.9 cm beyond the magnetic field boundary. The cylindrical condenser chamber is surrounded by a shield against reactor radiation, through which an ion conductor leads to the magnetic field. The mass-spectrometer can be moved to a distance of 4 m from the reactor for a change of fragment source. The electrostatic field separates fragments on the basis of the energy—effective charge ratio E/Z*. The magnetic field separates the fragments on the basis of the mass—charge ratio M/Z*. A semi-conductor detector is used to determine the E spectra of fission fragments that had passed through the fields and this makes it possible to determine the effective charge Z*. The mass-spectrometer is operated with the single order focusing conditions fulfilled for angles and velocities. Calibration is conducted according to the alpha particles of ^{238}Pu. The resolving power ($M^*/\Delta M^*$) = 300 at 0.1 of the peak height (where $M^* = M/Z^*$). The full free path of the fragments in the mass-spectrometer is 11.4 m and the time of fragment separation is about 1 microsecond. The paper describes the spectra of separated fragments. The spectral lines for close values of M/Z* are well divided and this makes it possible to identify the masses, energies and effective charges simultaneously, to investigate the β-decay and study the interaction of fission fragments with matter. (SW)

32289 (CONF-730618-, pp 249-254) OPTICAL PERFORMANCE OF THE RECOIL MASS SPECTROMETER LOHENGRIN. Moll, E. (Institut Max von Laue-Paul Langevin, Grenoble, France); Siegert, G.; Asghar, M. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The mass spectrometer for fission products "Lohengrin" was tested with an α-particle emitting point source. The results show that the deflection field strengths and the solid angle of the spectrometer are as calculated. The focal points of the two deflection fields were found to coincide and are separated only 5.4 cm from the calculated focal point. With full solid angle, a mass resolving power of 800 (full width at tenth maximum) was achieved. Further tests showed that the mass resolution at different places of the focal line is also satisfactory. By narrowing the entrance slits, one arrives at a mass resolution of 8000 (FWHM); this corresponds to a mass difference of about 12 MeV for fission products. If one can increase the resolution by a factor 3 to 4, the spectrometer should separate the different nuclear charges of a selected mass and give the charge distributions of fission products in a direct way. (auth)

32290 (CONF-730618-, pp 255-261) HIGH VOLTAGE PERFORMANCE OF AN ELECTROSTATIC SECTOR FIELD FOR UNSLOWED FISSION PRODUCTS. Hammers, H.; Moll, E.; Asghar, M.; Bailleul, G.; Bocquet, J. P.; Gautheron, J. P.; Greif, J.; Schrader, H.; Siegert, G. (Institut Max von Laue-Paul Langevin, Grenoble, France). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

An electrostatic sector field with a deflection radius of 5.6 m, a deflection angle of 35.35° and an electrode distance of 30 cm, has been constructed and tested. It can be operated at high-voltage values up to 700 kV after appropriate high-voltage conditioning. Sufficiently long measuring periods with low current ($<10^{-6}$A), i.e., little bremsstrahlung and low break-down rate, can be attained with a vacuum of 5.10^{-7} torr. (auth)

32291 (EFI-24-73) COMMUNICATION CHANNELS OF THE PDP-9 COMPUTER WITH EXPERIMENTAL FACILITIES. Avetyan, B. A.; Vasinyuk, I. E.; Dadyan, A. T.; Zverev, A. M.; Nanasyan, A. S.; Oganesyan, Z. O. (Erevanskij Fizicheskij Inst. (USSR)). 1973. 13p. (In Russian). INIS.

A description is given of the coupling of the PDP-computer with experimental installations. Program-control transmission channels were used. A block diagram is given and the operation of the interface channels and the coupling lines are described. A description is given of the necessary program provisions. (tr-auth)

32292 (EFI-32-73) PROGRAM FOR PROCESSING THE GRAPHICAL DATA ON THE PDP-9 COMPUTER DISPLAY. Mozharov, Yu. P. (Erevanskij Fizicheskij Inst. (USSR)). 1973. 7p. (In Russian). INIS.

The results of some studies on the formulation of a service program for the PDP-9 computer are reported. The system of a dialog program offers the possibility of an outlet to the 34N display, introduced in the computer complex, for graphic information with its subsequent transformation in the area of the curve being studied. The setting of the boundaries of the range and parameters of the transformation is done on the display screen with a light pencil. (tr-auth)

32293 (EUR-4898) HIGH-TEMPERATURE THERMOCOUPLES FOR USE IN NUCLEAR REACTORS. Mason, F.; Zeisser, P. (Commission of the European Communities, Brussels (Belgium)). 1972. 28p. INIS.

The manufacture, testing, and utilization of high-temperature thermocouple materials are briefly reviewed. It is intended to highlight various possible causes for the poor reliability of present-day thermocouples and to recommend future developments. Research and large-scale industrial production and involvement would improve the quality and reduce the price of high-temperature thermocouples, but this requires a minimum market which is considered to exist if the product were cheap and reliable. A solution to the problem is specifications backed by research within public organizations. (INIS)

32294 (IFVE-SPK-73-36) DEVICE FOR CONTROL AND LINK OF THE ASR-33 TELETYPE TO THE ICL-1903A COMPUTER. Borovikov, A. A.; Ivanov, A. A.; Maksimov, G. M.; Yakovleva, T. G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij) 1973. 21p. (In Russian). INIS.

The device for the control and linking of the teletype ASR-33 with the computer ICL-1903A is described. The structural scheme of the device and the principal circuits of the basic units are discussed. The operating principle is described. The slow channel of the ICL-1903A computer with standard communication lines was used for linking. (tr-auth)

32295 (INIS-mf-1363) AUTOMATION OF LABORATORY INSTRUMENTS. Farren, J.; Webster, R. K. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). [nd]. 5p. INIS.

From first international symposium on CAMAC in real-time computer applications; Luxemberg (4 Dec 1973).

The range of instruments used in chemical, clinical and solid state laboratories is reviewed, and their interfacing requirements grouped under high speed input, low speed analogue and digital input, and control functions. An outline is given of the current status and trends for various automation schemes. (INIS)

32296 (ORNL-TM-3802) LONG TERM DRIFT OF COMMERCIAL SHEATHED CHROMEL/ALUMEL THERMOCOUPLES AT 1600°F. Herskovitz, M. B.; Carr, K. R.; Mossman, C. A.; Hubbell, H. H. Jr. (Oak Ridge National Lab., Tenn. (USA)). Aug 1974. Contract W-7405-eng-26. 13p. Dep. NTIS $4.00.

An accelerated calibration drift test was run during 1968-70 on 31 Chromel/Alumel (type K) thermocouples sheathed with 304L stainless steel and insulated with MgO. These sensors were the best nuclear-grade thermocouples available from industry at the start of the LMFBR Temperature Sensor Development Program in 1968. Grounded and insulated junction thermocouples, 1/8 and 1/16 in. OD, reduced to size by swaging, drawing, or both, were checked for calibration drift and time to failure. After nearly 10,000 hr in air at 1600°F, the average indicated temperature of the 20 surviving thermocouples had drifted 19.8 ± 6.0°F (second figure is the standard deviation) from the true furnace temperature. The range of individual final drift values was from −39 to +33°F. All 15 thermocouples of 1/8 in. OD survived, but 10 of 16 thermocouples of 1/16 in. OD failed by oxidation of the sheath tips at the sensing junction. No initial inspection test was found that could predict the long-term calibration drift. Extrapolation from data of other workers indicated that at an LMFBR cooling-loop temperature of 1200°F in an alert atmosphere, the 1/8-in.-OD thermocouples and probably the 1/16-in.-OD thermocouples would survive for more than 1 year and their calibration drifts would be <1% if the temperature gradients affecting them did not change. (auth)

32297 NEW TYPE OF LEVEL GAUGE FOR DRAINAGE PLANT IN CONVENTIONAL AND NUCLEAR POWER STATIONS. Zimmermann, H. (Gerdts (Gustav F.) K. G., Bremen (F.R. Germany)). VGB Kraftwerkstechnik; 54: No. 7, 452-456(Jul 1974). (In German).

8 figs.

Arising from the requirements for reliability and for solving problems, a new type of binary level gauge has been developed. This utilizes the conductivity of the condensate to determine steam/condensate physical conditions. (auth)

32298 MULTICOLLECTOR, CYCLOIDAL FOCUSING, MAGNETIC MASS SPECTROMETER. Adams, N. G.; Smith, D. (Univ. of Birmingham, Eng.). J. Phys., E (London); 7: No. 9, 759-768 (Sep 1974).

The design and appraisal of a mass spectrometer, based on the focusing properties of mutually perpendicular electric and magnetic fields, is described. This field geometry spatially separates ions as a linear function of mass along a focal plane. This allows the spectrometer to be used in applications requiring the simultaneous monitoring of many ion species of independently varying intensities, such as from transient or pulsed ion sources, a feature not associated with other spectrometers. This instrument incorporates a novel detection system comprising a channel multiplier plate which considerably enhances sensitivity and a 50 element slatted collector array which separately detects the individual ion signals in the chosen mass range 20 to 70 u. To date a detailed experimental appraisal in the scanned E field mode, in which the resolved ion current spectrum is swept across one of the collectors, has provided data on the detailed mass peak profiles, the resolving power of the analyzing E × B field and the efficiency and dispersion of the detector system. The data provided by this investigation has allowed a detailed appraisal to be presented concerning the modifications required in order that the instrument can be operated in the constant E field mode in which the E field is fixed and the resolved ion current is distributed amongst the 50 collectors located behind the focal plane. (auth)

32299 FLAME DETECTOR OPERABLE IN PRESENCE OF PROTON RADIATION. Fletcher, J. C.; Walker, D. J.; Turnage, J. E.; Linford, R. M. F.; Cornish, S. D. US Patent 3,825,760. 23 Jul 1974. Filed date 21 Mar 1973. 16p.

A detector of ultraviolet radiation from the flame of a fire for operation in a space vehicle which orbits through high-intensity radiation areas is described. Two essentially identical ultraviolet sensor tubes are mounted within a shield which limits, to acceptable levels, the amount of proton radiation reaching the sensor tubes. The shield has an opening which permits ultraviolet radiation to reach one of the sensor tubes, hereafter referred to the sensing tube. However, the shield keeps ultraviolet radiation from reaching the other sensor tube, hereafter referred to as the reference tube. Both sensor tubes receive approximately the same amount of proton radiation, but the sensing tube also is able to receive ultraviolet radiation. The circuitry of the detector subtracts the output of the reference tube from the output of the sensing tube. Therefore, any portion of the output of the sensing tube which is due to proton radiation is offset by the output of the reference tube. Consequently, the output of the circuitry of the detector is proportional to the amount of ultraviolet radiation reaching the sensing tube. A delay circuit in the detector prevents false alarms by keeping statistical variations in the proton radiation sensed by the two sensor tubes from developing an output signal. (Official Gazette)

32300 ENHANCEMENT AND CONTROL OF RADIATION BEAMS BY VIBRATING MEDIA. Jacobs, A. M.; Kenney, E. S. (to Research Corp.). US Patent 3,832,562. 27 Aug 1974. Filed date 15 Jan 1973. 12p.

Disclosed are apparatus and methods for controlling radiation, such as a beam of neutrons, low energy gamma rays, x-rays, or electrons, by means of successive diffractions by diffracting media, such as crystals, vibrating in a compression mode in a shear mode or in a complex superimposed vibrational mode. The radiation beam may be subjected to successive diffractions by an arrangement of such vibrating diffracting media and may thus be contained in a substantially closed path such as a hexagonal path or a figure-eight path. Alternatively, the radiation beam may be subjected to one or more diffractions by an arrangement of such vibrating diffracting media for the purpose of controlling the beam in a non-closed path. (Official Gazette)

32301 RADIATION COLLIMATOR. Hura, M. (to Picker Corp.). US Patent 3,829,701. 13 Aug 1974. Filed date 29 Jan 1973. 10p.

A radiation collimator is described including opposed pairs of movable off-focus radiation diaphragms comprising interleaved arrays of plates supported centrally on stems. The stems of each opposed pair of diaphragms are pivotally supported and coupled together for concurrent movement toward and away from each other. Each opposed pair of off-focus diaphragms is interconnected to corresponding linkages on focus diaphragms movably mounted for rectangularly delineating the perimeter of the primary beam. The off-focus diaphragms extend to within very close proximity of the radiation source to block off-focus radiation. (Official Gazette)

32302 INCREMENTALLY-ADJUSTABLE REGULATOR FOR NUCLEAR PULSE GENERATOR. Koehler, D. R. (to Bulova Watch Co., Inc.). US Patent 3,829,697. 13 Aug 1974. Filed date 18 May 1972. 8p.

A nuclear pulse generator constituted by a source of radioactive material and a solid-state detector for sensing particles emitted by the source to produce corresponding output pulses is described. In order to regulate the count rate of pulses yielded by the generator, a section of the active detector surface is divided into a series of physically and electrically separated segments, each of which is connected to a common output terminal through a respective switch. By selective electrical connection of the detection segments, one can dictate whether or not the segments are counting. The ratio of the segment areas to each other is a binary number. The area of the smallest segment in the binary series to the total detection area is the desired resolution of the system, whereas the ratio of the sum of the segment areas to the total detection area corresponds to the range of regulation. (Official Gazette)

32303 PULSED NEUTRON LOGGING SYSTEM WITH GAIN COMPENSATION. Schultz, W. E.; Smith, H. D. Jr.; Arnold, D. M. (to Texaco Inc.). US Patent 3,829,686. 13 Aug 1974. Filed date 28 Jun 1973. 8p.

An illustrative embodiment of the invention includes method and apparatus for linearizing the gain of borehole gamma ray energy measurement apparatus. A known energy peak (or peaks) which is prominent in the gamma ray energy spectra of borehole measurements is monitored and any drift in its apparent location in the energy spectrum is used to generate an error voltage. The error voltage is applied in an inverse feedback manner to control the gain of system amplifiers to cancel the drift. (Official Gazette)

32304 METHOD FOR PROVIDING A NATURAL GAMMA-RAY LAG IN CONJUNCTION WITH ASSAY OPERATIONS WITHIN A BOREHOLE. Givens, W. W. (to Mobil Oil Corp.). US Patent 3,825,753. 23 Jul 1974. Filed date 6 Oct 1972. 6p.

A borehole logging tool is utilized to assay the formations surrounding the borehole by operating a pulsed neutron source to irradiate the formations with bursts of neutrons. A neutron detector monitors the delayed neutrons produced by the forma-

tions upon irradiation by the neutrons, and a gamma-ray detector monitors the delayed gamma rays produced by the formations upon irradiation by the source neutrons. The gamma-ray detector is also operated between assay operations to detect the natural gamma radiation of the formations being assayed. (Official Gazette)

32305 NUCLEAR TECHNIQUES FOR DETECTING THE PRESENCE OF EXPLOSIVES. Bartko, J. (to Westinghouse Electric Corp.). US Patent 3,832,545. 27 Aug 1974. Filed date 28 Sep 1972. 12p.

The invention pertains to a nuclear technique for monitoring objects such as luggage and parcels to determine the presence of specified nitrogen containing materials such as explosives as a function of the nitrogen content and concentration profile. Objects to be analyzed to determine the presence of nitrogen are subjected to a thermal neutron environment and the gamma ray radiation produced by the object in response to nitrogen reactions is monitored by gamma ray detectors. The gamma ray detectors produce indications of the nitrogen content of the object and the concentration profile of the nitrogen in the object. The information provided by the gamma ray detectors is processed to determine if the measured nitrogen content and concentration corresponds to a class of nitrogen containing material of interest, i.e. explosives. (Official Gazette)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

Refer also to abstracts 33048 and 33108–33115.

32306 (CONF-730618–) PROCEEDINGS OF THE 8th. INTERNATIONAL EMIS CONFERENCE ON LOW ENERGY ION ACCELERATORS AND MASS SEPARATORS, SKOVDE, SWEDEN, 12–15 JUNE 1973. Andersson, G.; Holmen, G. (eds.). (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Institutionen foer Fysik; Goeteborg Univ. (Sweden)). Aug 1973. 530p.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Sixty-five papers were presented at the conference. A separate abstract was prepared for each of 60 papers. The remaining 5 papers have been abstracted previously in NSA. For abstracts of these see 28: 8304, 28: 11385, 28: 14102, 28: 18409, and 28: 27552. (RCK)

For abstracts of individual papers see: 31735, 32288–32290, 32307–32339, 32876, 33046–33049, 33104–33115, 33483–33485, 33961, 34024, and 34025.

32307 (CONF-730618–, pp 6–16) DEVELOPMENTS IN THE ORNL ELECTROMAGNETIC SEPARATION PROGRAM. Love, L. O. (Oak Ridge National Lab., TN). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The status of the ORNL effort to computerize the electromagnetic separators used in stable isotope separation is presented. The effectiveness of the Oak Ridge 180° sector with computer-assisted operation is increased, and a plan to install computer equipment for data acquisition and operation assistance on an adjacent calutron is summarized. Computer equipment in use with the sector and some of the problems associated with it are compared with the benefits expected from a computerized calutron system. Once this effectiveness is demonstrated on the pilot calutron, similar equipment will be applied in the operation of 16 calutrons starting with data acquisition and then adding operational control. Collections involving high-purity isotopes are reviewed, giving comparison of isotopic purities from various charge compounds and feed systems. In mercury separation a feed of elemental mercury from a water-heated reservoir promoted rapid start-up time, while platinum-metals feeds from the elements with chlorine trifluoride produced improvement in all phases of the operational process. (auth)

32308 (CONF-730618–, pp 137–142) NEW METHOD OF INTERNAL METAL OXIDE REDUCTION IN ELECTROMAGNETIC ISOTOPE SEPARATION. Bruening, D.; Ihle, H. R.; Lipperts, H. (Kernforschungsanlage, Juelich, Ger.). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

High overall yield is of particular importance for separations of precious preenriched or radioactive isotopes with laboratory separators. In the course of Yb-isotope separations with the SIDONIE II separator at the Julich Nuclear Research Center (KFA) it has been found that overall efficiencies of 20 to 32% can be obtained when ytterbium oxide is reduced to the metal in the ion source by a constant flow of calcium vapor. These yields are a factor 4 to 6 higher than the best results, which have been obtained by the use of volatile compounds of rare earth elements with the same separator. Yb-ion currents up to 1 mA can be collected and the enrichment factors are comparable to those obtained with chlorides or internal chlorination by CCl_4. During extended separations, cathode life is greatly increased by the activation of the Ta-cathode which can be maintained at relatively low temperature. Due to gettering by calcium vapor a continuous improvement of the separator vacuum is observed during long runs which leads to higher transmission and enrichment. Using this method ^{168}Yb, preenriched to ~22.5% at ORNL, has been deposited in hollow cathodes for optical hyperfine spectroscopy with an isotopic purity ≥99.4%. In a single pass separation using natural ytterbium oxide as feed material ^{168}Yb has been enriched to 90.4% and ^{170}Yb to ≥99.0%. The internal calcium reduction has also experimentally been shown to be applicable to the separation of Sm-isotopes. Generally, one should expect that this method can be used successfully with most metal oxides, particularly lanthanide and actinide oxides, perhaps with the exception of ThO_2, if the ion source can be operated in the temperature range required for the volatilization of the elements. (SW)

32309 (CONF-730618–, pp 143–146) PRELIMINARY RESULTS CONCERNING THE SEPARATION OF RARE GASES IN A CLOSED LOOP CIRCUIT. Meunier, R.; Camplan, J.; Ligonniere, M.; Moroy, G. (Laboratoire Rene Bernas, Orsay, France). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

There is a serious need for about 30 mg of ^{21}Ne with a purity better than 99% for spectrographic studies. This extremely low abundant isotope is separated from a pre-enriched mixture in order to both save time and obtain high purity. Because of the high cost of the feed material, a continuous re-injection system of the non-ionized gas into the ion source has been developed (closed loop system). This system includes a five steps compressing device. The gas collector has been modified and includes a liquid helium trap because of the high vapor pressure of neon. The compressing device as well as the modified collector are described. Results on purity and efficiency are given. (SW)

32310 (CONF-730618–, pp 147–149) SIMULTANEOUS COLLECTION OF ALL MERCURY ISOTOPES. Meunier, R.; Camplan, J.; Ligonniere, M.; Moroy, G. (Laboratoire Rene Bernas, Orsay, France). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A collector for use in Sidonie which allows simultaneous collection of all stable mercury isotopes is described. The mercury ions are neutralized on a graphite plate which is water cooled. They rebound from this plate and are collected on a stainless steel plate covered by teflon. This stainless steel plate is cooled by liquid nitrogen. During a 10 hours separation, about 250 mg can be collected. The overall efficiency (including source and collector efficiencies etc...) is about 15%. The enhancement factors of one mass relative to any adjacent one can reach 150. (SW)

32311 (CONF-730618–, pp 150–154) ENRICHMENT OF ^{138}La FROM NATURAL ISOTOPIC ABUNDANCE. Neubert, A.; Wagner, R. (Kernforschungsanlage, Juelich, Ger.). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

In preparing highly enriched samples of ^{138}La in single pass separations starting with anhydrous $LaCl_3$ some aspects of collection and contamination have been studied. Simultaneous bombardment of five hollow cathodes (HC) with an average current of 0.107 μA per HC during 20.2 h resulted in final enrichments of 70 to 73% ^{138}La, which means enrichment factors E = 2620 to 3030 at a relative mass difference of $\Delta M/M = 0.0072$. Decreasing abundances of 50.5% (E = 1145), 36.3% (E = 640) and 27.5% ^{139}La (E = 425) were found in deposits at diaphragms and at the backside of a shutter placed before the HC's. The amount of La in the HC's was 76% of the current integral equivalent, as determined by activation analysis in an experiment with ^{139}La. Total $^{138}La^+$ ion current was 1.5 μA average and 2.7 μA maximum. In a subsequent separation, the distribution of the self sputtered La deposit inside a ^{138}La receiver pocket (P) was found using activation analysis of ^{139}La combined with mass analytical data. Retention was over 95%. Fifty-four percent of the sputtered La was concentrated on only 15% of the inner pocket wall surface and, with 80.5% ^{139}La (E = 4650), showed considerably better enrichment than the rest of the deposit all over the pocket (75.2% ^{138}La, E = 3400). Enrichment factors in the HC and P separations are above the figures of merit of the SIDONIE separators published in 1970. Contamination calculations considering small angle scattering yield somewhat higher final abundances of 72 to 81% ^{138}La (HC) and 86 to 90% ^{138}La (P) at the observed residual pressure ranges, which were different in the two separations. (SW)

32312 (CONF-730618–, pp 163–167) NEW ION SOURCE FOR ELECTROMAGNETIC ISOTOPE SEPARATOR. Meunier, R.; Camplan, J. (Laboratoire Rene Bernas, Orsay, France). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

This new ion source is derived from the classical Bernas type ion source (arc discharge ion source). It utilizes the magnetic field due to the large cathode DC current. Results are given on efficiency and plasma oscillations (hash) under normal operating conditions. (SW)

32313 (CONF-730618–, pp 174–179) LENS EFFECT OF THE HOLE OR SLIT IN THE EXTRACTION ELECTRODE OF HIGH CURRENT ION SOURCES. Menat, M.; Chavet, I.; Kanter, M. (Soeq Nuclear Research Centre, Yavne, Israel). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A reasonable knowledge of the factors determining the divergence of the ion beam in electromagnetic isotope separators is important in order to adjust properly the extraction parameters and to design accordingly the extraction geometry for space charge compensation of the ion beam. One of the factors is the hole or slit in the extraction electrode acting as a diverging lens. This so-called anode-hole effect has been calculated long ago by Davisson and Calbick for space charge free configurations. This effect has also been treated for covergent strong electron guns in cases where space charge cannot be neglected. This lens effect has been calculated for high density divergent ion beams in electromagnetic separators. The electrode shapes satisfy the various conditions imposed by the theories of Langmuir and Pierce combined. The expression obtained consists of the classical Davisson and Calbick term and an additional term of smaller value, due to the space charge. Because of the complexity of the various contributing phenomena, the effect has been treated only approximately. (SW)

32314 (CONF-730618-, pp 186-190) P.A.R.I.S.; THE NEW ISOTOPE SEPARATOR AT ORSAY. Camplan, J.; Meunier, R.; Fatu, C. (Laboratoire Rene Bernas, Orsay, France). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A new isotope separator has been constructed at Orsay for separation of stable elements in mg quantities. The characteristics of the magnet are the following: $\phi = 100°$ Rm = 60 cm, index 0.5, normal entrance and exit. By use of a nonsymmetric arrangement (distances source-magnet = 0.9 m and magnet-focus = 1.6 m) a dispersion of 1500 mm is obtained. Results are given on the tests made with this machine. (SW)

32315 (CONF-730618-, pp 191-198) DESCRIPTION AND PERFORMANCE OF THE MEIRA E.M.I. SEPARATOR. Chavet, I.; Kanter, M.; Levy, I.; Sar-El, H. Z. (Soreq Nuclear Research Centre, Yavne, Israel). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

MEIRA is an isotope separator whose assembly has been recently completed at the Soreq Centre. It was designed for a relatively high output without sacrifice of enrichment power or other desirable qualities of the instrument. This has been achieved by a special type of ion optics and various improvements in other aspects of the machine. It corrects third order aberrations which are still appreciable for high intensity beams. Important features of the separator are: C-type magnet (7.5 tons), main gap 8 cm, magnetic field homogeneous to $+10^{-4}$ and stabilized to $\pm 10^{-5}$, curved boundaries equipped with magnetic shields, acceleration voltage 50 KV stabilized to $\pm 2 \times 10^{-5}$, wedge-type ion beam emitted from a slit up to 10 cm length, maximum divergence ±0.1 radian, maximum beam intensity 100 mA, baffled total pumping speed 5000 l/s. Original solutions were found for certain theoretical and practical problems during the development of the separator. Among these were the following: calculation of Pierce-type electrodes for a divergent wedge beam, development of servo-systems for semi-automatic control of the ion source, development of a reliable and reproducible variable leak with a response proportional to an electric signal for coupling to this servo-system, development of the stabilized high voltage power supply, design of the mechanism for electrode movement (5 independent degrees of freedom) located, together with the corresponding valve, inside the diaphragm of the "differential pumping". The general performance of the separator is described, based on the first trial runs. (SW)

32316 (CONF-730618-, pp 205-213) MINIATURE ELECTROMAGNETIC ISOTOPE SEPARATOR. Abrahamsen, P.; Joergensen, H. E.; Skilbreid, O. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A description is given of the design of a very compact electromagnetic mass separator covering the mass range 1 to 80 A.M.U. Curves showing ion current and resolving power as function of ion energy are shown and briefly discussed. (auth)

32317 (CONF-730618-, pp 214-219) IMPROVEMENTS OF THE ISOTOPE SEPARATOR AT GOTEBORG FOR ION-SOLID INTERACTION STUDIES IN ULTRA HIGH VACUUM. Holmen, G. (Chalmers Univ. of Tech., Goteborg). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

With improvements of the isotope separator at Goteborg ion-solid interaction studies can be performed during clean target conditions and a pressure ranging from 1×10^{-9} to 5×10^{-11} torr for ion beams in the current interval from a few μA to nA and dose rates from 6×10^{14} to 6×10^{11} ions/cm^2 sec. Sputtering, kinetic secondary electron emission, and ion implantation measurements have been performed. (SW)

32318 (CONF-730618-, pp 346-348) ZBIR: A PROJECT OF AN ISOL SYSTEM ON THE REACTOR. Piotrowski, A.; Klepacki, P.; Sulik, A.; Ludziejewski, J.; Jastrzebski, J. (Inst. for Nuclear Research, Swierk, Poland). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

An isotope separator is now under construction at the Institute for Nuclear Research in Swierk for on line experiments in the reactor. This note provides information on the present status of the isotope separator construction, some characteristics of the new reactor, and the adopted fission product transport system from the reactor core to the separator ion source. (auth)

32319 (CONF-730618-, pp 356-358) BEAM SWITCHING PRINCIPLE FOR ISOL FACILITIES. Andersson, G. (Chalmers Univ. of Tech., Goteborg). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

For several reasons it is advantageous if the settings of the isotope separator proper can be left unchanged during an ISOL experiment, that is, if the mass spectrum in the focal plane is kept in constant position. At the same time, however, there is most often a need for freedom to vary the mass number studied in each of the several instruments supposed to be used simultaneously in the run. The solution of this problem outlined is based on electrostatic deflection in sectors of cylindrical capacitors, which are movable in the beam plane along directions making angles equal to the sector angles with the separated beams (assumed to be parallel to each other in the ideal case). Thus any beam within the working range of a deflector can be selected and directed into a fixed exit tube, connecting to the measuring instrument. Small deviations from parallelism of the beam pattern (characteristic of, for instance, the 55° type of separator) are readily corrected for by slight changes of deflector voltage or by simple ion optical devices at the entrance. (SW)

32320 (CONF-730618-, pp 365-370) COUPLING OF AN E.S. QUADRUPOLE DOUBLET WITH POST-ACCELERATION OR RETARDATION COLLECTOR SYSTEMS AT THE FIRST ORSAY SEPARATOR. Truong, C. M.; Fournet-Fayas, J.; Levy, G.; Obert, J. (Univ. Paris-Sud, Orsay, France). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The use of an E.S. quadrupole doublet close after the focal plane and working in connection with either a post-acceleration system or a retardation collector is outlined. It provides a very convenient and more practical means of beam-handling and focusing related to collection problems. In the future, this set-up will be extensively used in all post-accelerated and decelerated collections and systematic investigations in building-up of stable retarded isotope thick targets will be performed. (SW)

32321 (CONF-730618-, pp 371-378) RAPID CHEMICAL SEPARATION TECHNIQUES COMBINED WITH AN ISOL-SYSTEM. Grapengiesser, B.; Rudstam, G. (Swedish Research Council's Lab., Studsvik). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

At an on-line facility such as OSIRIS, where many fission elements are processed simultaneously in the isotope separator, the samples will usually contain several isobaric components. A chemical separation step is therefore needed. By using thermochromatographic techniques an apparatus has been constructed which permits very rapid chemical separation of the isobars. An ion beam is allowed to enter the apparatus through a narrow entrance tube and to hit a collector (foil or filament). The collector is kept hot so that the collected elements rapidly diffuse to the surface and evaporate. The desired component of the gaseous mixture, thus obtained, is caught on a disc kept at a temperature corresponding to the deposition temperature of the component in question. Less volatile components are adsorbed in the vicinity of the collector and more volatile ones are removed through a waste tube. The method allows chemical separations to be carried out within a few seconds. An advantage is that the method involves only one step. Thus it can be used in a continuous manner which means steady-state conditions as regards the activity of the samples. A further advantage is that daughter products of lower deposition temperature than the desired component are continuously removed. In such cases the sample stays pure with no growing-in of daughter activities. (SW)

32322 (CONF-730618-, pp 379-381) ON-LINE ELEMENT SEPARATION AT THE COLLECTOR END. Hornshoej, P. (Univ. of Aarhus, Denmark); Jonson, B.; Ravn, H. L.; Westgaard, L. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A simple apparatus for on-line element separation of activities

deposited or formed as decay products on the collector side of an ISOL-System is being developed. Two results are described with a prototype version designed to separate neutron-deficient mercury isotopes from their platinum daughters formed in α-decay. The ion beam is stopped on one of a series of 0.02 mm thick gold foils, mounted in a "windmill" arrangement driven by a stepping motor. After the collection, the foil is moved to the next position where it is heated for a preset time. The next step brings the foil in front of a Si surface barrier detector. A good separation (less than 0.1% Hg and more than 90% Pt left on the foil) was obtained with a heating period of 4 seconds at a temperature of 800°C. With this separation method it is hoped to be able to determine the expected weak delayed proton branches from ^{177,175}Pt, i.e., the daughter products from α-decay of ^{181,179}Hg. The technique may evidently be adapted to any pair of elements (and maybe compounds) which show a sufficiently great difference in their evaporation rates from the collector foil. (SW)

32323 (CONF-730618-, pp 382-388) BEAM HANDLING SYSTEM FOR ISOLDE 2. Kugler, E. (CERN, Geneva). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Since, after the reconstruction of the ISOLDE facility, there will be no access to the collector chamber of the isotope separator proton irradiation, all experiments will depend on the extraction of ion beams from this chamber and a flexible and efficient beam handling system which should transport the ion beams to collector position outside the 2nd shielding wall. Immediately after the collector chamber the ion beams will be electrostatically deflected through the angles 13°, 26°, 36° and 56° respectively. These 4 pairs of deflector plates can be moved independently and with sufficient overlap in order to give a free choice over a wide range of isotopic beams. After this switchyard, each one of the beams will be made almost parallel by means of an electrostatic quadrupole lens and refocussed by another lens after several meters of drift length. It is planned to insert in one of the beam lines a second analyzing magnet of comparatively small dispersion aiming to decrease the isotopic contamination of one selected beam. This high purity will be favorable for work on isotopes with very low production yield. This purified beam can then be either focussed on a collector position in the experimental hall or, as a future development, be transported to the upper floor of the building where the radiation level will be even lower. (SW)

32324 (CONF-730618-, pp 389-396) SIMULTANEOUS DETERMINATION OF Z AND A FOR NUCLEI WITH A UP TO APPROX. 50 BY COMBINATION OF THE MAGNETIC ANALYSIS AND THE ΔE,E METHOD. Artukh, A. G.; Avdeichikov, V. V.; Eroe, J.; Gridnev, C. F.; Mikheev, V. L.; Volkov, V. V.; Wilczynski, J. (Joint Inst. for Nuclear Research, Dubna, USSR). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The use of on-line mass-separators at accelerators and in reactors offers a variety of possibilities for the identification of new nuclei and the study of their properties. However the ion sources of these mass-separators are, as a rule, suitable for the study of only certain chemical elements, while versatile ion sources make it difficult to establish Z of the nuclei under investigation. These difficulties are especially significant in the case of the isotopes very remote from the beta stability line because their production cross sections are small. Therefore, special interest is taken in the methods facilitating the simultaneous determination of Z and A of nuclei, irrespective of their chemical properties. A method of charged particle identification is described which is based on the combination of the magnetic analysis and the ΔE, E method. A telescope of thin and thick semiconductor detectors is put into the focal plane of the magnetic analyzer. (auth)

32325 (CONF-730618-, pp 397-404) NOVEL ION BEAM HANDLING AND COLLECTION TECHNIQUES AT THE TRISTAN FACILITY. Talbert, W. L. Jr.; McConnell, J. R.; Halbig, J. K.; Siege, G. A. (Ames Lab., IA). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

As studies of short-lived nuclei have progressed at the TRISTAN facility, several improvements to ion beam handling and collection have been developed, in order to expedite the monitoring and control of the ion beams of the separator. A nonmechanical scanner has been constructed to determine beam profile and separator focusing for currents down to 50 pA for beams not used in experiments. For on-line studies, a beam "skimmer" has been developed to control the activity deposited on a moving tape by means of adjusting vertical deflection of the ion beam. The high-resolution $\pi\sqrt{2}$ beta-ray spectrometer has been operated successfully on-line, using a special movable tape collector which makes possible beam position stabilization within the spectrometer. A "final" design of a moving tape collector has been constructed for use with gamma-ray and beta-ray or conversion electron detectors, which employs a modular concept for versatility and features fast (60 cm/sec) tape motion capabilities. A neutron detection facility has also been set up using a moving tape collector. (SW)

32326 (CONF-730618-, pp 412-419) VERSATILE INTEGRATED TARGET-SURFACE IONIZATION SOURCE FOR ON-LINE ISOTOPE SEPARATIONS. Amiel, S.; Nir-El, Y.; Shmid, M.; Venezia, A.; Wismontsky, I. (Soreq Nuclear Research Centre, Yavne, Israel). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Short-lived fission produced halogens, alkalis and indium were studied on-line with a mass separator using a versatile integrated target-ion source, based on surface ionization. A large area target consisting of graphite foils coated with uranium is placed inside a heated chamber and exposed to a thermal neutron beam. The fission products diffuse out of the target chamber and pass through a heated tantalum guide tube, where they undergo ionization and are extracted into the mass separator. In the case of negative surface ionization, where halogens are separated, the intense electron emission is deflected by a small magnet placed near the exit of the ionizing tube. The temperatures of the target and ionization chamber are controlled separately to optimize speed of separation, selectivity and ionization efficiencies. Hold-up time, efficiency and specificity as functions of the temperatures and dimensions have been studied and are reported. Diffusion half-times, which govern the transport times from the target, were found to decrease regularly below 10 sec with increasing temperatures above 1500°C. Overall efficiencies for halogens of >0.1% and >1% for alkalis were obtained. The ionic purity of the isotopic beam was determined by simultaneously counting the ions and measuring the radioactivity. Using this source, short lived halogen and alkali fission products were separated and studied. The performance of this source is demonstrated through presentation of new results of nuclear properties and independent fission yield values measured in the course of this work. (SW)

32327 (CONF-730618-, pp 420-425) ON-LINE STUDY OF GASEOUS FISSION PRODUCTS; RAPID TRANSFER TECHNIQUES. Feldstein, H.; Amiel, S. (Soreq Nuclear Research Centre, Yavne, Israel). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Gaseous fission products, especially krypton and xenon, from thermal fission of ^{235}U have been transferred rapidly to an on-line isotope separator (SOLIS) and the separated beams have been studied at the collector for radioactive decay and rate of collection. One target used contained ~2.5 g ^{235}U in the form of U-stearate and the transfer time of the emanated rare gases from the target to the collector was determined by the rate of activity growth at the collector. Two configurations of this target have been studied and compared for their transfer time distributions. In parallel, a new method based on the He-jet technique has been studied. The irradiated target is swept by a pre-treated helium stream and the fission products extracted by a capillary tube, where high linear velocities are obtained. The bulk of the carrier gas is removed by a differential pumping and a skimmer while the fission products, most of which are in the form of high molecular weight clusters, proceed with a small dispersion angle (<4°) into a second evacuated compartment leading to the discharge chamber of the ion source. Two types of target were studied, i.e., one based on emanation of rare gases from stearate, and one based on stopping recoils in the carrier gas. The performance of the different set-ups are discussed in view of fission yield results and nuclear properties of the short-lived nuclei studied. (SW)

32328 (CONF-730618-, pp 426-431) APPLICATION OF CERAMIC OXIDES AT HIGH TEMPERATURES AS ISOL-TARGETS. Hansen, F.; Lindahl, A.; Nielsen, O. B.; Sidenius, G. (Niels Bohr Inst., Copenhagen). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The isotopes of mercury, thallium, lead, bismuth, polonium, astatine, radon and francium, formed as spallation products, have been separated on-line from targets of thorium oxide at temperatures up to 2000°C. The targets were used in connection with the MITIS-system and the ISOLDE-separator at CERN. In this system, ion sources of the hollow cathode type are utilized. A considerable amount of information on yields as a function of element and mass numbers corresponding to the bombardment of thorium with 600 MeV protons was collected. The lightest spallation product seen with reasonable intensity was ^{185}Hg, formed in the reaction ^{232}Th (p, 11p, 37n). In addition, a search has been made for the elements produced by the fission of thorium. Silver, cadmium, antimony, tellurium, iodine, xenon and caesium were observed, with effi-

ciencies which seem to be similar to those obtained for the heavy elements. Light fission fragments were seen with the same intensity as the heavy, but they have not been isotopically analyzed until now. A target of thorium carbide showed a performance similar to the oxide targets, except that the yield of francium was suppressed. (SW)

32329 (CONF-730618-, pp 432-444) NEW MOLTEN-METAL TARGETS FOR ISOLDE. Ravn, H. L.; Sundell, S.; Westgaard, L. (CERN, Geneva). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

New target and ion source systems have been developed for the reconstructed on-line separator (ISOLDE-2). The system constitutes a further development of the molten-metal target for the production of alkali elements by means of surface ionization. The design has been modified for maximum operations reliability and ease of handling, and the method is extended to new regions of elements. (SW)

32330 (CONF-730618-, pp 445-450) HE-JET ON-LINE ION SOURCE OF THE UNISOR MASS SEPARATOR. Schmidt-Ott, W. D.; Mlekodaj, R. L. (UNISOR, Oak Ridge, TN). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

In a recent publication transport efficiencies for recoils from heavy ion reactions with the use of He-jet systems and feasibility studies of such transport systems for the on-line operation of the UNISOR mass separator were reported. Subsequently, new capillary-skimmer systems have been constructed and connected on-line with the separator. Gamma and alpha-ray spectra have been measured on-line and the total efficiency improved to the point that it is now 0.1% using a hollow cathode ion source. (auth)

32331 (CONF-730618-, pp 451-455) PRODUCTION OF PURE SHORT-LIVED Te AND Sb SOURCES WITH AN ISOTOPE SEPARATOR SEMI-ON-LINE SYSTEM. Wigmans, M. E. J.; ten Brink, B. O.; Heynis, R. J.; van der Kam, P. M. A.; Paanakker, L. A.; Verheul, H. (Vrije Univ., Amsterdam). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A method has been developed to perform a chemical separation between radioactive Te and Sb isotopes produced in Sn foils in the ion source of an isotope separator. This separation is based on the difference between the evaporation velocities of Te and Sb out of molten Sn at a certain temperature. The separation efficiency for Te and Sb present in Sn foils has been measured as a function of the time of presence of the foil in the ion source; by making an adequate choice of this time it is possible to evaporate all the Te-activity out of the irradiated target, while other activities of Sb, Sn, and In remain in the target. When a mass-separated target is used this procedure can be very important also for the decay study of the shortliving Te-nuclei, because the activity of Sb, Sn and In isotopes with the same mass number can be very high, thus giving a contamination, which disturbs the decay study of the Te-isotope. Besides this it can identify new found activities, as in our case ^{112}Te and ^{113}Te. With this method sources have been obtained of $^{112-117}$Te, with a very high chemical and isotopic purity, giving lots of new information about the decay of these isotopes. The decay of ^{112,113}Te has been observed for the first time. The half-lifes are 1.8 and 1.5 minutes, respectively. (SW)

32332 (CONF-730618-, pp 456-462) EXPERIENCE WITH CHEMICAL COMPOUNDS AS TARGETS FOR THE PRODUCTION AND ISOTOPE SEPARATION OF CARRIER FREE NUCLEI. Wolf, G. K.; Fritsch, T.; Dreyer, J. (Univ., Heidelberg). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Until now very little experience has been gained with chemical compounds as targets for the production and mass separation of short lived nuclei. A number of targets have been studied with respect to their chemical properties but their performance in connection with the ion source of an isotope separator is not known in most cases. In the last two years a number of targets have been tested with respect to the behavior of the volatile compounds of the radioisotopes in a gas discharge ion source. As examples, the evaporation and mass separation of Ga, Ge, As, Se, and Zr isotopes, produced via spallation in $SrCl_2$ targets and of I, and Te isotopes produced via fission in a target consisting of a mixture of U_3O_8 and B_2O_3 are described. The status of an on line experiment with the latter target is reported. (auth)

32333 (CONF-730618-, pp 463-468) NEW TARGET ARRANGEMENT FOR THE OSIRIS FACILITY. Andersson, C.; Grapengiesser, B.; Rudstam, G. (Swedish Research Council's Lab., Studsvik). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Previously, the target used at OSIRIS has been a layer of uranium oxide coating the internal mantle surface of the discharge chamber in the ion source. A cylinder made of graphite cloth and placed inside the discharge chamber caught the fission recoils which subsequently diffused to the surface and evaporated. In this kind of arrangement the useful target thickness is an amount corresponding to the range of the recoils. In an attempt to increase the amount of target material a cylinder of graphite cloth has been soaked with uranyl nitrate and then ignited. This cylinder, when put into the discharge chamber, proved to be an efficient target arrangement. The amount of uranium was increased by a factor of four, and the strength of the samples obtained considerably improved. The efficiency of the system has been measured for 18 different elements. (SW)

32334 (CONF-730618-, pp 469-476) ON LINE SEPARATION OF FISSION FRAGMENTS AT THE STRASBOURG REACTOR. Zirnheld, J. P.; Schutz, L. (Univ. Louis Pasteur, Strasbourg). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The aim of the experiment was the collection of isolated fission products, particularly in the rare earth area. Schematically, the equipment is the following: a ^{235}U target sealed in a container filled with helium under a 3 kg pressure is placed in a 5.10^{10} neutron flux. The fission fragments are slowed down forming clusters which flow together with the gas through a capillary tube ending in a hollow cathode ion source. The fission products are ionized and next separated by means of a magnetic sector. One collects in this way, on a sample conveyor, most of the masses which are obtained in the fission reaction. The first results have shown, through conventional methods of nuclear spectroscopy, that short period elements (of the order of one second) and rare earth nuclides can be identified. (SW)

32335 (CONF-730618-, pp 477-480) ON-LINE SEPARATOR ASTERIX. Wollnik, H. (Justus Liebig Univ., Giessen, Ger.); Brandt, R.; Ewald, H.; Jungclas, H.; Kornahl, G.; Snider, D.; Wagner, H.; Walcher, W.; Wilhelm, H. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

For the analysis of short lived heavy ion reaction products a He-jet ion-source mass separator is under development by the ASTERIX cooperation. The complete installation is designed to contain a high temperature heavy ion target, a He-jet transport system, an ion source, a mass separator and a particle detection system. Up to now a mass separator has operated with a thermal ion source that ionizes short lived Cs-isotopes produced in fission of ^{235}U. γ-spectra of ^{141}Cs to ^{145}Cs are under investigation. A progress report on the final system is given that contains the design of a heavy ion target that can sustain an ion beam of several KW, a He-jet ion source that ionizes fission fragments at the moment with an overall efficiency of about 1% for high ion currents. Such high ion currents are necessary if the overall efficiency for fast decaying particles must be high. The separator design further shall allow a very high resolving power M/AM of more than 50,000 so that different elements within one isobaric β-decay chain can be separated from each other. (SW)

32336 (CONF-730618-, pp 481-489) HELIUM-JET SYSTEM DESIGNED TO FEED AN ION SOURCE. Wilhelm, H. G. (Justus Liebig Univ., Giessen, Ger.); Jungclas, H.; Wollnik, H.; Snider, D. F.; Brandt, R.; Roebig, G. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The development of an efficient He-jet transport system offers the possibility of a useful He-jet-ion source coupling. Early investigations required the presence of a strong ionizing environment at the source of the radioactive particles for the formation of "clusters." Later work indicated the simple alternative of using an uv-lamp, which opened the possibility of investigating sources independently of an accelerator beam. Measurements are reported of a highly efficient transport system for fission fragments of ^{252}Cf using uv-light in a separate "cluster breeder." Without an uv lamp only 0.01% to 0.1% of the activity coming from the ^{252}Cf source could be transported through the capillary. UV light gave an increase to more than 10%. Trace amounts of additives increased the transport efficiency up to 80%. For the purpose of coupling an ion source to the system, a second vacuum chamber is necessary with a skimmer between the two stages. The experimental setup enabled one to collect, behind the skimmer, up to 40% of all fission products leaving the ^{252}Cf source. By comparison of the K x-ray spectra taken from the fission fragments collected directly at the ^{252}Cf and those taken from the transported particles, a significant change in the abundance of elements could not be found. (SW)

32337 (CONF-730618-, pp 490-497) CORRECTION EXPERIMENTS BETWEEN A HELIUM JET AND AN ION SOURCE. Snider, D. F. (Justus Liebig Univ., Giessen, Ger.); Wagner, H.; Jungclas, H.; Wollnik, H.; Mazumdar, A. K.; Wilhelm, H. G. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

In order to study the problems associated with the connection of an electromagnetic mass separator and a helium gas jet, a hollow cathode ion source was coupled to the helium gas jet at Giessen. In the first experiments, the transmission of clusters carrying decay products of ^{228}Th through the cold ion source was observed. Later a ^{252}Cf source was used to produce radioactive nuclides by fission. From the activity transferred to the ion source by means of the helium jet up to 10% were collected behind the cold ion source. With the ion source operating and an acceleration voltage of 15 kV, ionization efficiencies up to 3% were obtained. The measured values depended strongly on the pressure in the tubing connecting the ion source to the skimmer of the helium jet. The influence of the geometry of the connection and of the cluster material on the overall efficiency is discussed. (SW)

32338 (CONF-730618-, pp 498-504) MEASUREMENTS OF THE INFLUENCE OF THE PENNING EFFECT ON THE IONIZATION EFFICIENCY IN GAS MIXTURES. Mazumdar, A. K.; Wagner, H. (Philipps-Univ., Marburg, Ger.). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

An on line separator for use on the heavy ion accelerator of the Gesellschaft für Schwerionenforschung at Wixhausen is being planned. The slowing down of the nuclear reaction products and their transport into the ion source of the separator will be made by means of a helium gas jet. The carrier gas helium is mixed with organic or inorganic cluster material besides the nuclear reaction products. For the ionization of these admixtures the excited metastable helium atoms in the discharge may play an important role. They are able to ionize nearly all elements by second order collisions (Penning effect), e.g., was observed that by this effect an ionization efficiency of 14% could be reached for argon which was mixed with 1% helium while at the same time the ionization efficiency of the carrier gas helium was smaller by about 3 orders of magnitude. The influence of different gas mixtures both organic and inorganic on the ionization efficiency of the admixture and on the suppression of the ionization of the carrier gas helium is discussed. (SW)

32339 (CONF-730618-, pp 505-514) PRINCETON ON-LINE SEPARATOR. Naumann, R. A. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The Princeton isotope separator has been moved and installed in the zero degree external beam line of the sector focused isochronous cyclotron. The first target system employs a liquid target chamber containing 150 mls of perchloroethylene (C_2Cl_4) connected to the ion source of the separator by means of a vacuum line and baffled liquid nitrogen trap. During proton bombardment of the target with microampere beam currents several hundred watts is deposited and vigorous boiling occurs. The majority of the vapor and liquid spray is reflux— condensed by means of two vertical condensers in the line cooled with chilled water. The remaining vapor transports the radioactive argon-35 to the trap, the argon alone then passing to the ion source. Hold up times of 0.9 seconds have been observed with this system. The second target system consists of a hot molybdenum tube supported from the back plate of the ion source. The cyclotron beam enters the molybdenum tube through a thin tantalum window, the tube is resistance heated and equipped with heat shields. Using a target consisting of fine nickel powder and graphite bombarded by alpha particles radioactive zinc isotopes with mass numbers 60 to 63 have been observed. Hold up times of approximately 25 seconds have been measured. (SW)

32340 (K-1863) NEON ISOTOPE SEPARATION BY GASEOUS DIFFUSION TRANSPORT IN THE TRANSITION FLOW REGIME WITH REGULAR GEOMETRIES. Fain, D. E.; Brown, W. K. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). 13 Sep 1974. Contract W-7405-eng-26. 134p. Dep. NTIS $5.45.

A comprehensive study of the pressure dependence of the transport and transport ratio of neon isotopes by gaseous diffusion through regular geometries has been made. The pressure range was such that the Knudsen number or the ratio of capillary radius to gas mean free path varied from about 0.05 to 10. The measurements were made using parallel plates and capillaries with radii from 5 μ to 25 μ, length-to-radius ratios from 4 to 900, and materials of construction including glass, plastic, and gold. The results are compared with available theories and an interpolation formula for the data is given, which is an empirical modification of the Present and deBethune theory to include effects of flow anomalies and real gas flow pressure dependence. Both the flow and transport ratio measurements clearly show anomalies which are probably caused by deviations from cosine law wall scattering, but they are not completely consistent with each other. (auth)

32341 INCREASING THE EFFICIENCY OF ISOTOPE SEPARATION CASCADES BY USING STAGES WITH A NUMBER OF OUTPUT FLUXES. Kolokol'tsov, N. A. At. Energ. (USSR); 37: No. 1, 32-34(Jul 1974). (In Russian).

Various schemes of cascades consisting of stages with three outputs were considered. Equations describing the separation process in such cascades were obtained. It is shown that the use of non-symmetrical cascades consisting of stages with three outputs makes it possible to increase cascade efficiency by 57%. (auth)

32342 URANIUM ENRICHMENT BY LASERS. Umsch. Wiss. Tech.; 74: No. 11, 354(Jun 1974). (In German).

2 refs.

Enrichment of the uranium isotope 235 by lasers is a promising new technology which was classified for several years. A tunable dye laser of molecular laser must be adjusted to very precise frequencies to excite atoms or molecules of one isotope of a particular element. The excited isotope can then be ionized and separated by electrical order magnetic forces; the molecules may be separated by chemical reactions. (auth)

32343 URANIUM ENRICHMENT BY MEANS OF LASER RADIATION. Wiss., Wirt., Polit.; 4: No. 21, 8-9(May 1974). (In German).

A short communication concerning the concept of separating isotopes—particularly uranium isotopes—by means of laser radiation is presented. (GE)

Isotopic Power Sources

Refer also to abstracts 31886, 31887, 32437, 32438, and 32568.

32344 (LA-5705-MS) SAFETY TEST No. S-6 LAUNCH PAD ABORT SEQUENTIAL TEST. Phase I. Low-Velocity HSA IMPACT. Snow, E. C. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1974. Contract W-7405-eng-36. 28p. Dep. NTIS $4.00.

Phase I of the MHW Safety Test No. S-6 was conducted at LASL on March 22, 1974. This low-velocity impact test consisted of preheating a simulant MHW-RTG heat source and dropping it from a 45.7-m (150-ft) tower onto a concrete target pad. The heat source impacted at approximately 30 m/sec (100 fps), at an angle of 60° to the horizontal plane. The nearly inelastic impact resulted in the failure of the outer clad along most of the weld joints and a complete breakup of the aero-shell. The remains did provide containment for all but two of the fuel sphere assemblies (FSA), that rolled a few feet away from the point of impact. All 24 FSA's were intact, with the post impact sphere assemblies (PISA) contained within the graphite impact shell (GIS). No thoria release was detected in the target area or on any of the post-impact containment shells (PICS) during posttest examinations, even though several of the Ir PICS suffered small cracks. (auth)

Radiation Sources

Refer also to abstracts 31888 and 32465.

32345 LEAK TESTING RADIOACTIVE BRACHYTHERAPY SOURCES. Regulatory Guide 6.1, Revision 1. Washington, DC; Atomic Energy Commission, Directorate of Regulatory Standards (1974). 2p. (ICONS-01807).

A standard condition included in all AEC licenses for possession and use of sealed brachytherapy sources requires that these sources be periodically leak tested, that the test be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample taken from the source, and that the source be immediately withdrawn from use if the test reveals the presence of 0.005 microcurie or more. This guide describes methods and procedures acceptable to the Regulatory staff for leak testing radioactive brachytherapy sources. (TFD)

Design and Fabrication

Refer also to abstracts 32437 and 32568.

32346 SMALL SEALED-SOURCE PREPARATION-RESULTS OF ENQUIRIES. Simpson, P. (Cookridge Hospital, Leeds, Eng.). Radiography; 40: No. 476, 177-178(Aug 1974).

Some of the practical tuition procedures employed by schools of radiotherapy in the British Isles for the training of students in the preparation of small sealed sources were surveyed by means of a questionnaire. The results from 55 of the total of 62 schools recorded the practices employed and the attitudes of staff to students preparing radioactive small sealed sources (as opposed to dummy sources) during training. This data is supplemented by information on the actual working procedures of qualified radiographers. (UK)

32347 RADIATION ABSORBER AND INTENSITY COLLIMATOR UNIT. Hall, L. S.; Heffan, H. (to Secretary of the Navy). US Patent 3,832,564. 27 Aug 1974. Filed date 31 Jan 1973. 6p.

A radiation absorber which automatically and/or digitally controls the intensity of a radiation source by providing an absorbent measured fixed path for the radiation beam to travel, by the use of a cylindrical helically shaped step wedge to control the intensity of the radiation emitted from the radiation source is described. By changing the angle of the cylindrical shaped step wedge, the thickness of the material in the path of the beam emitted from the source changes, thereby changing the flux of the beam. (Official Gazette)

Industrial Uses

Refer also to abstracts 32569 and 32570.

32348 (AED-CONF-73-273-003) NEW ASPECTS OF FOOD CONSERVATION. Fricker, A. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe (F. R. Germany)). 1973. 1p. (In German). (CONF-730699-1).

From German congress for further training in medicine; Berlin, F. R. Germany (12 Jun 1973).

New aspects of food preservation including irradiation of foods with special reference to the preservation of the nutrients are reviewed. (GE)

32349 (BNWL-1824) LIST OF AEC RADIOISOTOPE CUSTOMERS WITH SUMMARY OF RADIOISOTOPE SHIPMENTS, FY 1973. Simmons, J. L. (comp.). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1974. Contract AT(45-1)-1830. 37p. Dep. NTIS $4.00.

This tenth edition of the AEC radioisotope customer list has been prepared at the request of the Commission's Division of Biomedical and Environmental Research. It is a compilation of radioisotope sales during FY 1973 by AEC facilities at Argonne National Laboratory, Battelle-Pacific Northwest Laboratories, Brookhaven National Laboratory, United Nuclear Inc., Idaho Nuclear Corporation, Hanford Engineering Development Laboratory, Mound Laboratory, Oak Ridge National Laboratory, and Savannah River Plant. The information is divided into four sections. The first is an alphabetical list of domestic and foreign customers. Included are the isotopes purchased by each customer and the laboratory supplying each isotope. The second section is an alphabetical list of isotopes, cross-referenced to customer numbers and again divided into the domestic and foreign categories. The third section is an alphabetical list of states and countries, also cross-referenced to customer numbers, indicating geographical concentrations of isotope users. The final section is a comprehensive table providing an alphabetical listing of the isotopes and a breakdown of shipments, quantities, and dollars for each isotope under the Domestic, Foreign, and Project (AEC facilities) categories as well as the total figures for each isotope. (auth)

32350 (CONF-740655-) CONFERENCE ON NUCLEAR TECHNOLOGY, CAPE TOWN, SOUTH AFRICA, JUNE 1974. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). 1974.

Separate abstracts were prepared for the 8 papers presented at the conference. (WHK)

For abstracts of individual papers see: 31469, 31618, 32272–32274, and 32351–32353.

32351 (CONF-740655-, pp P1p1-6) PRINCIPLES AND HAZARDS OF RADIOACTIVITY AND ITS TECHNOLOGICAL APPLICATION. Basson, J. K. (Atomic Energy Board, Pelindaba, South Africa). 1974.

From conference on nuclear technology; Cape Town, South Africa (Jun 1974).

The phenomena of radioactivity, as well as the emission and properties of ionizing radiations, are discussed. The biological effects of these radiations are briefly indicated, and the resultant radiation protection measures described. Finally, the principles of application of radioactive isotopes and radiation are outlined, with specific reference to South African accomplishments. (auth)

32352 (CONF-740655-, pp P2p1-3) NUCLEAR TECHNIQUES. Snyman, G. C. (Atomic Energy Board, Pelindaba, South Africa). 1974.

From conference on nuclear technology; Cape Town, South Africa (Jun 1974).

The functioning of nuclear gages is explained. Examples of a few novel techniques are added to demonstrate the flexibility of radioisotope techniques. Tracer applications of radioisotopes as a means of measuring parameters of continuous processes are emphasized. An increased demand for on-stream composition gages and for tracer applications is predicted. (auth)

32353 (CONF-740655-, pp P4p1-9) PUTTING THE ATOM TO WORK IN LOCAL INDUSTRY. Bain, C. A. R. (Southern Universities Nuclear Inst., Faure, S. Africa). 1974.

From conference on nuclear technology; Cape Town, South Africa (Jun 1974).

The application of nuclear techniques by industry in the Western Cape is reviewed. It is concluded that radiation gages are adequately employed, and the use of radioactive tracers increasingly realized. The potential of more sophisticated techniques, e.g., analytical methods, still await exploitation by local industry. (auth)

32354 THE CONTINUOUS TRACING OF THE WEAR BEHAVIOR OF TRANSMISSION LUBRICANTS IN THE FZG GEAR WHEEL-BRACING TESTING MACHINE BY MEANS OF RADIONUCLIDE TECHNIQUES. Ruedinger, V. (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (F.R. Germany)). Erdoel Kohle, Erdgas, Petrochem.; 27: No. 4, 201-204(1974). (In German).

From joint meeting of the 'Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V.' together with the 'Verein fuer Tiefbohrtechnik e.V.' and the 'Arbeitskreis Chromatographie' of the 'Fachgruppe Analytische Chemie' in the 'Gesellschaft Deutscher Chemiker'; Braunschweig, F. R. Germany (3 Oct 1973). 7 figs.; 1 tab.; 14 refs.

By means of deuteron irradiation of the gear flank of the pinion in a cyclotron a thin layer of radioactive material is produced. The abrasion particles which arrive at the oil are continuously determined by a flow method. Wear quantities of a few μg can be detected so that gear oils can be much better differentiated with regard to their lubricating properties. As the material abrasion is directly determined, a number of interfering effects can be excluded. By activation of single zones it is possible to measure the wear rate varying with the height of the gear flank. A large number of testing runs is possible for the measurement of the wear behavior using a tuned-up gear wheel pair. This is of great significance for the quick development of optimum oil compositions. (auth)

32355 OBLUCHENNYI POLIETILEN V TEKHNIKE. (Irradiated Polyethylene in Engineering). Knyazev, V. K.; Sidorov, N. A. Moscow; Izdatel'stvo Khimiya (1974). 376p.

The results of domestic and foreign studies on polyethylene modified by irradiation are generalized and systematized. The different aspects of its practical use in contemporary engineering as a new high-quality insulating and construction material are examined in detail. (tr-auth)

32356 SPATIAL DISTRIBUTION OF IONIZATION INTENSITY NEAR RADIOISOTOPIC NEUTRALIZERS OF STATIC ELECTRICITY. Rozenkrantz, A. S. Sov. At. Energy (Engl. Transl.); 34: No. 1, 44-45(Jan 1973).

Translated from At. Energ. (USSR); 34: No. 1, 35(Jan 1973). This is a summary of paper No. 632/6739 with full copy held at TIC.

For proper use of a radioisotopic static-electricity neutralizer it is necessary to calculate the electric fields and the volt–ampere characteristics of interelectrode gaps ionized by radiation. Among others, such calculations require the knowledge of the spatial distribution of the number of ionization events N_i per unit volume and time. For surfaces covered with α- and β-active isotopes the spatial distribution of N_i can be calculated by the method based on the thickness of the active layer d_a and of the protective layer d_p which can be represented in relative units: $d_a = (d_a/l_{am})$; $d_p = (d_p/l_{pm})$, where l_{am} and l_{pm} are the total ranges of the given particle in the active and protective layers. The results are given of calculating the spatial distribution near a plane active surface of ^{239}Pu for a very thin ($d_a = 0.09$, $d_p = 0.01$) and a very thick ($d_a = 0.5$ $d_p = 0.5$) layer; experimental and theoretical results were compared for a practical active layer with $d_a = 0.3$ and $d_p = 0.1$ and were found to be in good agreement. The obtained results indicate that the layer thickness has a significant effect on the spatial distribution of N_i. The effect of external contamination of the active surface can be allowed for in the same number. The method is extended to β-active isotopes by taking into account their energy spectrum. (TFD)

LIFE SCIENCES

32357 (ORNL-4967) MOLECULAR ANATOMY (MAN) PROGRAM. Semiannual Progress Report, September 1, 1973–February 28, 1974. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. Contract W-7405-eng-26. 110p. Dep.

It was found that antiserum to the glycoprotein "spike" component of bromelain-treated Respiratory Syncytial (RS) can be used in serologic assays to distinguish between surface and internal antigenic components of the RS virus. The ribonucleoprotein of RS virus was characterized. Protein kinase activity was demonstrated with purified RS virus but the origin has not been established. Work with Hepatitis A virus suggests that it should tentatively be classified with the parvovirus group of animal viruses. In a majority of cases, Hepatitis B antigen specific DNA polymerase activity can be detected in plasma from acutely infected individuals. A miniature analytical system based on the GeMSAEC principle was built and evaluated as a ground-based clinical system. Because of the high correlation with data from the older 15-cuvet GeMSAEC, the miniaturized system has been placed in daily use in the Health Division at ORNL. A uric acid procedure has been developed using the miniature Fast Analyzer and has replaced the continuous flow analyzer method formerly used in the Health Division. Prototype UV analyzer and computer systems are being evaluated at three locations. Reagent parameters were adapted for cerate oxidative monitoring of liquid chromatography. A series of studies was made on the optimal configuration of a tube reactor for developing color or fluorescence in an LC detection system, and five new uv-absorbing compounds were identified in body fluids. Work continues in image processing. Cycling chromatography was applied to several studies, including the exhaustive subtraction of human placental extract, human cancer serum, and proteins isolated from the urine of melanoma patients by antibodies isolated from the serum drawn from pregnant human multiparous females at term. A Nanosecond Fluorescence Spectrometer System has been assembled, tested, and operated. It is hoped that this system may be used for studying various aspects of the antigen-antibody reaction and might point the way to simple assay procedures. The characterization and utilization of immobilized biospecific proteins on polyacrylamide gels was carried out during this report period. Work continues with the blood cell separator to discover means of procuring sufficient effective granulocytes for therapy of granulocytopenic patients. This involves theoretical models of blood sedimentation; monitoring and control system for the Aminco celltrifuge; axial and radial flow blood cell separators; biocontainment; and ex vivo immunosorption. (auth)

Radiation Effects on Biochemicals

Refer also to abstracts 31659, 31660, 32376, 32380, 32470, 32477, 32590, and 33041.

32358 (AEC-tr-7571, pp 30-35) CHANGES IN THE SECONDARY STRUCTURE OF BACTERIAL DNA UNDER THE ACTION OF LOW DOSES OF IONIZING RADIATION. Samoilenko, I. I.; Serna, F. R.; Ivanov, K. K. (Inst. of Epidemiology and Microbiology, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 185-189(1974).

The influence of γ irradiation on the secondary structure of DNA of bacteria with different radiosensitivity, differing in nucleotide composition of the DNA, was studied. A statistically significant decrease in the melting point of DNA was demonstrated after irradiation at a dose of 0.5 krad. The radiation vulnerability of the secondary structure of bacterial DNA in the case of irradiation in the dose range 0.5 to 10 krad did not depend on the nucleotide composition. The absence of selective damage of AT or GC pairs of DNA during irradiation at the indicated doses was demonstrated by the method of differential spectrophotometry. (tr-auth)

32359 (AEC-tr-7571, pp 152-155) MECHANISM OF THE ACTION OF GAMMA-NEUTRON IRRADIATION ON THE MOLECULAR STRUCTURE OF DNA. Rekun, G. M.; Shur'yan, I. M. (Inst. of Molecular Biology and Genetics, Kiev). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 277-279(1974).

The influence of fast neutrons on the molecular structure of DNA was studied in experiments in vitro. (tr-auth)

32360 (CEA-N-1594, pp 118-121) RADIOBIOLOGY. Polverelli, M.; Teoule, R. 1972. (In French).

In Semi-annual progress report No. 2.

Work effected during the 2nd half of 1972 at the Grenoble Fundamental Research Department in the field of radiobiology is briefly reviewed: influence of thymidine radiolysis products on DNA replication of ehrlich ascites cells; gamma radiation effects on chlorella. (auth)

32361 (CONF-721001-, pp 185-206) RADIATION EFFECTS ON SIMPLE BIOLOGICAL SYSTEMS. Myers, L. S. Jr. (Atomic Energy Commission, Washington, DC). 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

This paper focuses on the chemical aspects of radiation effects. First some general considerations are discussed, then work with model systems is described, and, finally, some ideas about applicability of the findings to radiation biology are developed. Much emphasis is placed on the radiation chemistry of nucleic acids. (auth)

32362 (CONF-721001-, pp 256-265) RELATIONSHIPS BETWEEN SOME SPECIFIC DNA LESIONS AND SOME RADIOBIOLOGICAL EFFECTS IN BACTERIA. Hutchinson, F. (Yale Univ., New Haven). 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

This paper gives some evidence on the production of single-strand breaks in DNA by ionizing radiations and the repair of these breaks. The advantages are mentioned using the well-characterized break produced by the action of ultraviolet light on DNA containing the base analog bromouracil. The difficulties of measuring the production and the repair of double-strand breaks are pointed out, particularly the speed-dependent sedimentation of very large DNA in sucrose gradients. Recent results show that for Bacillus subtilis cells double-strand breaks are repaired, and only cells with all double-strand breaks repaired can form colonies. The role of Auger effects in creating double-strand breaks is discussed. The importance of determining the mechanisms by which mutations are formed is emphasized also. (auth)

32363 (COO-78-325, pp 42-72) RADIATION BIOCHEMISTRY SECTION. Evans, H. H.; Biaglow, J. E.; Brewer, E. N.; Evans, T. E.; Nygaard, O. F. 1974.

In annual report for period ending April 30, 1974.

Progress is reported on studies on the effects of γ irradiation on DNA replication in the slime mold Physarum polycephalum both in vivo and in cell-free nuclear preparations obtained from this organism; RNA synthesis in Physarum; a search for mutants of amoebae defective in DNA synthesis; and the metabolic effects of anoxic radiosensitizers on cultured tumor cells. References are included to publications that report the results of completed studies. (CH)

32364 SPECIFIC RECOGNITION OF SINGLE-STRANDED REGIONS IN ULTRAVIOLET-IRRADIATED AND HEAT-DENATURED DNA BY TRYPTOPHAN-CONTAINING PEPTIDES. Toulme, J. J.; Charlier, M.; Helene, C. (CNRS, Orleans, France). Proc. Nat. Acad. Sci. U.S.A.; 71: No. 8, 3185-3188(Aug 1974).

Fluorescence studies of the binding of peptides containing lysyl and tryptophyl residues to nucleic acids show that two types of complexes are formed. One of them involves a direct interaction of the tryptophyl ring with nucleic acid bases, which leads to fluorescence quenching. Comparison with proton magnetic resonance and circular dichroism data indicates that this fluorescence quenching is due to a stacking of the indole ring with bases. Quantitative analysis of fluorescence data leads to the conclusion that stacking is favored in single-stranded regions of DNAs, which are produced either by heating or by uv irradiation of the native DNA sample. The binding of the peptide Lys-Trp-Lys is about ten times tighter in these single-stranded regions as compared with double-stranded ones. A short tripeptide such as Lys-Trp-Lys is, therefore, able to discriminate between single-stranded and double-stranded regions. Moreover, bound peptide molecules photosensitize the splitting of thymine dimers in uv irradiated DNA, thus providing a model for DNA photoreactivation. (auth)

32365 NUCLEAR COUPLING OF ^{33}S AND THE NATURE OF FREE RADICALS IN IRRADIATED CRYSTALS OF CYSTINE DIHYDROCHLORIDE. Hadley, J. H. Jr.; Gordy, W. (Georgia State Univ., Atlanta). Proc. Nat. Acad. Sci. U.S.A.; 71: No. 8, 3106-3110(Aug 1974).

The ^{33}S hyperfine structure has been observed and analyzed in the electron spin resonance of γ-irradiated single crystals of cystine dihydrochloride at 77°K and at room temperature. The radicals observed at room temperature and previously assigned

as RCH_2S are proved to be disulfide radicals, RCH_2SS. However, the RCH_2S radical is identified by the ^{33}S measurements in samples irradiated at 77°K, annealed at 200°K, and observed at 77°K. This monosulfide radical appears to undergo reactions to form disulfide radicals at room temperature. (auth)

32366 METHOD TO DETERMINE THE SPECIFIC RADIOACTIVITY OF DNA IN YEAST CELLS AND ITS APPLICATION TO X-IRRADIATED CULTURES. Yamaguchi-Koll, U. Berlin, Ger.; Freie Univ. (1972). 62p. (In German). INIS.

Thesis. 25 figs.; 3 tabs.; 84 refs. With abstract. Available from the library of the Freie Univ. Berlin.

With yeast cells, contrary to most other cells, a labelling of DNA with the help of exogenially offered thymine or thymidine is not possible. A method was therefore worked out to enable the selective determination of DNA also after non-specific labelling. The essential steps are alkaline degradation of RNA and specific hydrolysis of DNA by means of DNase. This method avoids time-consuming chemical separation processes of DNA and RNA, can be carried out in small additions without much effort, and is thus suitable for series tests. With the help of this method, it could be shown that a considerable "reutilization" of nucleic acid particles takes place in ^3H adonesine-labelled logarithmically growing cultures. Application of the method to x-irradiated cultures gave evidence of on dose-dependent repair replication, which compared to the controls exhibits a great fall in the specific radioactivity of DNA at complete arrestment of the net DNA synthesis (with synchronized as well as asynchronous cultures). Simultaneously, it could be shown that there is essentially little difference in the labelling of the acid soluble pool in controls and irradiated cells. Thus a method is available which can be principally applied to all labelling of DNA with any nucleic acid particles. (GE)

32367 RELEASE OF TRITIUM ACTIVITY FROM 6-^3H-THYMINE IRRADIATED IN VITRO AND IN VIVO. Ryznar, L.; Drasil, V. (Inst. of Biophysics, Brno). Stud. Biophys.; 43: No. 3, 171-180(1974).

The release of tritium activity into aqueous medium was studied in aqueous solutions of 6-^3H-thymine and 2-^{14}C-thymine mixture irradiated both in the presence and absence of oxygen. The degree of release was estimated partly by determining the radioactivity of the water obtained by the evaporation of the irradiated thymine solution, partly by its chromatography; the decrease of ratio of tritium to carbon radioactivity was measured at individual peaks of the eluates. On the basis of the data representing tritium activity release into aqueous medium during the irradiation of EAT cells labelled by 6-^3H-thymidine, it is calculated that the energy which under given experimental conditions should be absorbed in the DNA of the cells to achieve a radiation injury of the thymine molecule, does not exceed the value of 10 eV. (auth)

32368 INTERACTION OF HETEROLOGOUS DNA WITH LYMPHOCYTES. III. Incorporation of DNA After Their u.v. or γ Irradiation. Keprtova, J. (Inst. of Biophysics, Brno). Stud. Biophys.; 42: No. 2, 127-134(1974).

Bacterial DNA irradiated with u.v. or γ and its incorporation into lymphocytes is studied. Prior to incorporation into lymphocytes DNA prepared from Escherichia coli was irradiated with u.v.-light ($32.4 \cdot 10^4$ ergs/mm²) or with various doses of γ-radiation. A greater amount of bacterial DNA irradiated with u.v.-light than that of nonirradiated DNA was incorporated into lymphocytes during 30 minutes of incubation. The major part of u.v.-irradiated DNA incorporated into cells appeared in nuclei. The intensity of incorporation of DNA decreased in dependence on the increasing exposition to γ-radiation. The most expressive decrease in the incorporation of bacterial DNA (down to 62 per cent) occurred after irradiation with 246,000 rads; the molecular weight of DNA, as compared with the original molecular weight of nonirradiated DNA, decreased to 43 per cent. (auth)

32369 FORMATION OF DENATURED DNA AFTER γ IRRADIATION OF CHEMICALLY MODIFIED DNA SOLUTIONS. Lukasova, E.; Palecek, E. (Inst. of Biophysics, Brno). Stud. Biophys.; 42: No. 2, 81-85(1974).

In preceding papers it was assumed that the formation of single-stranded DNA induced by irradiation of the solutions of double-helical DNA was influenced not only by interruption of sugar-phosphate backbone but also by damage to bases. In order to test the assumption a cautious chemical modification of small number of bases in double-helical DNA was performed by means of $NaHSO_3$ and H_2O_2. Considerably lower doses of radiation brought the formation of denatured DNA in the samples in which several bases were modified before irradiation. It is possible to suppose that the radiation damage to bases decreases locally the stability of the double-helical DNA structure. (auth)

32370 STRUCTURE OF U.V.-IRRADIATED DNA. Lang, H. (Zentralinstitut fuer Mikrobiologie und Experimentelle Therapie, Jena). Stud. Biophys.; 42: No. 2, 157-159(1974).

A model representing the structure of native and uv-irradiated DNA is presented. The model shows the following characteristics: upon uv-irradiation not only hydrogen bonds of AT base pairs directly involved in dimerization but also other AT and GC base pairs located in the vicinity of dimer regions are disrupted; as a consequence additional nondisrupted base pairs are slightly tilted against the helix axis; the formation of thymine dimers leads to local distortions, i.e., modification of the distance between the stacked base pairs in the neighboring regions of the dimer involving changes in winding angle between base pairs and increase in the helicity. (HLW)

32371 EXCISION OF DAMAGED THYMINE RESIDUES FROM GAMMA-IRRADIATED POLY(dA-dT) BY CRUDE EXTRACTS OF ESCHERICHIA COLI. Hariharan, P. V.; Cerutti, P. A. (Univ. of Florida, Gainesville). Proc. Nat. Acad. Sci. U. S. A.; 71: No. 9, 3532-3536(Sep 1974).

Crude extracts of E. coli endo I⁻ and E. coli endo I⁻ uvrA6⁻ possess the ability to remove thymine products of the 5,6-dihydroxy-dihydrothymine type from γ-irradiated or osmium tetroxide-oxidized poly(dA-dT). It is shown that the uvrA-gene product, which is responsible for incision close to photodimers in prereplication ultraviolet repair in E. coli, is not required for, but may aid in, the excision of γ products of the 5,6-dihydroxy-dihydrothymine type. Ring-damaged thymine products are also removed by E. coli extracts from osmium tetroxide-oxidized poly(dA-dT), which contains only 5,6-dihydroxy-dihydrothymine but no strand breakage, indicating that product excision occurs in the absence of radiation-induced breaks. On the average, 8 to 16 nucleotides are removed from the polymer per ring-damaged thymine residue excised by extracts from both strains and for γ-irradiated and osmium tetroxide-oxidized polymer. (auth)

32372 IONIZING RADIATION-INDUCED LESIONS IN T4 PHAGE AND ESCHERICHIA COLI DNAs AS SITES FOR INITIATION OF DEGRADATION IN VIVO. Marsden, H. S.; Ginoza, W. (Pennsylvania State Univ., University Park). Int. J. Radiat. Biol.; 25: No. 5, 481-495(May 1974).

The initiation of endogenous cellular DNA degradation, which follows gamma-irradiation of E. coli, has been shown to occur at ionizing-radiation lesions in the DNA itself. This result was obtained by comparing the patterns of DNA degradation of gamma-irradiated T4 DNA in various radiation-sensitive Escherichia coli strains with the reported patterns of gamma-induced endogenous bacterial DNA degradation in the same corresponding strains. There were the following similarities: (1) recBC nuclease (recB and recC genes) that was responsible for DNA degradation of irradiated E. coli cells was also responsible for the degradation of DNA of the irradiated T4 phage. (2) An increased degradation of both DNAs was seen in polA1⁻ cells over that in the parental polA1⁺ cells. (3) The enzymatic defect in uvr⁻ strains, A, B, or C all showed the same lack of effect on the levels of degradation of phage DNA as that shown for bacterial DNA degradation, the levels being the same as in their parental uvr⁺ strain. (4) The main products of the degradation of these DNAs, followed by ^3H-thymidine labelling, were thymine and a phosphorylated derivative of thymidine. The slope of the plaque-forming survival curve of gamma-irradiated T4 on P3478 and JG138 (polA1⁻) was 10 per cent greater than that on W3110 and JG139 (pol⁺). Endonuclease I defect had no effect on the level of degradation of DNA of gamma-irradiated T4 seen in endonuclease I⁺ parental strain. (auth)

32373 DEGRADATION OF T4 DNA DURING INFECTION OF ESCHERICHIA COLI AT LOW MULTIPLICITY OF INFECTION. Evidence for Radiation- and Non-Radiation-Induced Components. Marsden, H. S.; Ginoza, W. (Pennsylvania State Univ., University Park). Int. J. Radiat. Biol.; 25: No. 5, 465-479(May 1974).

Degradation of T4 phage DNA in Escherichia coli infected at low multiplicity of infection has been studied. Results showed that the degradation had two distinguishable components: one induced by ionizing radiations (β particles of ^3H decays or γ rays), the other induced in the absence of radiation. The extent of radiation-induced degradation was directly proportional to dose up to 1 to 2 phage lethal hits. This linear relationship indicated that the degradation was initiated at the sites of radiation lesions. At higher doses, the level decreased with dose. The extent of non-radiation-induced degradation was 1 to 3 per cent of the T4 genome. (auth)

32374 RADIOPROTECTION OF BIOLOGICALLY-ACTIVE DNA BY CYSTEAMINE. A Rapid-Mix Study. van Hemmen, J. J.; Mueling, W. J. A.; de Jong, J.; Luthjens, L. H. (Rijksverdedigingsorganisatie TNO Rijswijk, Netherlands). Int. J. Radiat. Biol.; 25: No. 5, 455-464(May 1974).

Protection of purified biologically active bacteriophage DNA by cysteamine against radiation damage was studied in rapid-mixing experiments, under conditions where protection was only due to

reactions between irradiated DNA and unirradiated protector. It was shown that the formation of single-strand breaks, a few msec after irradiation in the absence of oxygen, could be influenced by the addition of cysteamine, leading to a reduction of the number of breaks. The amount of lethal nucleotide damage was shown not to be affected. (auth)

Radiation Effects on Cells

Refer also to abstracts 32363, 32367, 32473, 32477, 32529, and 34531.

32375 (AEC-tr-7571, pp 111-115) RADIOPROTECTIVE ACTION OF NATURAL SUBSTANCES CONTAINED IN THE DIET OF RADIORESISTANT RODENTS. Shvydkii, V. V.; Parkhomenko, I. M.; Burlakova, E. V. (Moscow State Univ.). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 247-250(1974).

The radioprotective action of peptic hydrolyzates from plants included in the diet of radioresistant animals (mongolian and great gerbils) and collected from their habitat was studied. Optimum conditions for the preparation and storage of the hydrolyzates, as well as periods of administration, ensuring a maximum level of protection, were selected. Hydrolyzates from Salsola collina (DRF = 1.32), Cochia prostrata (DRF = 1.34), Salsola arbuscula (DRF = 1.40), as well as ketolactone, a substance isolated from Artemisia multicomlis, at the All-Union Institute of Medicinal Plants (DRF = 1.30 to 1.44), exhibit a radioprotective action on SOC cells cultured in vitro. (tr-auth)

32376 (CONF-721001-) PHYSICAL MECHANISMS IN RADIATION BIOLOGY. Proceedings of a Conference Held at Airlie, Virginia, October 11-14, 1972. Cooper, R. D.; Wood, R. W. (eds.). (USAEC Division of Biomedical and Environmental Research, Washington, D. C.). 1974. 332p. Dep. NTIS $10.60.

Sixteen papers presented at the conference are included. Separate abstracts were prepared for 13 papers. The remaining 3 papers were previously announced in NSA. For abstract numbers of these papers see CONF-721001- in the Report Number Index. (MCG)

For abstracts of individual papers see: 31616, 31617, 32361, 32362, 32377-32379, 32398, and 34019-34023.

32377 (CONF-721001-, pp 11-16) SOME TOPICS IN MOLECULAR RADIOBIOLOGY. Hutchinson, F. (Yale Univ., New Haven). 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

This paper discusses the major kinds of radiobiological effects of interest—loss of ability of a cell to reproduce, mutagenesis, carcinogenesis, and teratogenesis. A summary is given of the results which indicate that radiation-induced lesions in DNA are important causes of these biological effects. Finally, a brief summary is given of the repair of DNA lesions by cellular enzymes. (auth)

32378 (CONF-721001-, pp 266-287) RADIATION EFFECTS OF EUKARYOTIC CELLS. Tobias, C. A. (Univ. of California, Berkeley). 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

This paper traces some current ideas about radiation effects on eukaryotic cells. Some general remarks on cell biology for radiation scientists who do not have background in this field are followed by a discussion of radiation interactions in cells at the molecular and cellular levels. The paper is, of necessity, a brief and incomplete summary. (auth)

32379 (CONF-721001-, pp 288-295) MECHANISMS OF SENSITIZATION IN CELLS AND CELLULAR MODELS. Sinclair, W. K. (Argonne National Lab., IL). 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

Models of radiation damage in cells must be able to explain dose modifications due to protective or sensitizing agents. Biochemical sensitizers incorporate in the cell or bind to components in it in times of the order of minutes or hours. If they form a stable compound in the cell, as does N-ethylmaleimide (NEM), they are usually effective whether added before, after, or during irradiation. Such agents modify repair mechanisms in the cell. Studies with synchronous Chinese hamster cells in culture show that NEM is more effective in reducing cell survival at the end of the S period than at any other stage of the cell cycle. The NEM binds to intracellular sulfhydryl and thus, together with DNA synthesis, which lethal radiation damage is known to depend on, leads to a two-component model of cellular radiosensitivity, one factor being DNA synthesis and the other some critical fraction of the intracellular sulfhydryl. (auth)

32380 (COO-78-325) ANNUAL REPORT FOR PERIOD ENDING APRIL 30, 1974. (Case Western Reserve Univ., Cleveland, Ohio (USA). Dept. of Radiology). 1974. Contract W-31-109-eng-78. 129p. Dep. NTIS $9.50.

Separate abstracts were prepared for the three sections of the report: radiation physics, cellular radiobiology, and radiation biochemistry. (MCG)

For abstracts of individual sections see: 32363, 32381, and 34026.

32381 (COO-78-325, pp 18-41) CELLULAR RADIOBIOLOGY SECTION. Rustad, R. C.; Oleinick, N. L. 1974.

In annual report for period ending April 30, 1974.

Preliminary results are reported from studies on the γ radiosensitivity of Arbacia eggs and sperm as measured by mitotic delay, the post-irradiation regeneration of cilia in sea urchin embryos and Tetrahymen, and the effects of radiation on protein synthesis in Tetrahymena and rat liver. References are included to publications that report the results of completed studies. (CH)

32382 INDUCTION OF THYMIDINE- AND IUdR-RESISTANT VARIANTS IN P388 MOUSE LYMPHOMA CELLS BY X-RAYS, UV AND MONO-, AND BIFUNCTIONAL ALKYLATING AGENTS. Anderson, D.; Fox, M. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Mutat. Res.; 25: No. 1, 107-122(Oct 1974).

Dose-response curves for "mutation" to resistance to 5-iodo-2-deoxyuridine (IUdR) and excess thymidine (TdR) in P388 mouse lymphoma cells have been established after exposure of these cells to six chemical mutagens, UV and ionising radiations. The dose-response curves for all mutagens in both selective systems show considerable similarities when induced mutation frequencies are plotted against survival. Expression time for both types of variants, $IUdR^r$ and TdR^r, are similar, i.e., maximum frequencies are reached by 48 h and there is no fall in variant frequency at late expression times up to 144 h. Over the range of survival levels studied there appears to be little or no dependence of expression time on dose of mutagen. Some loss of mutants after high doses (i.e., at low survival levels) was observed due to the fact that a significant proportion of both TdR^r and $IUdR^r$ clones were more sensitive to the mutagens than the wild-type population. The similarities in induced dose-response curves for different mutagens suggest that the mutants have a common origin, probably an error in repair, but it seems unlikely that errors in "cut and patch" repair are responsible. A comparison of spontaneous frequencies of $IUdR^r$ and TdR^r variants suggests that IUdR is mutagenic in P388 cells. (auth)

32383 FURTHER EVIDENCE OF THE POSSIBLE MECHANISMS INVOLVED IN THE RESTORATIVE EFFECT OF DNA IN X-IRRADIATED MAMMALIAN CELLS. Petrovic, D.; Ferle-Vidovic, A.; Nagy, B. (Inst. Rudjer Boskovic, Zagreb). Stud. Biophys.; 43: No. 1, 13-18(1974).

In order to provide further evidence of the possible mechanisms involved in the restorative effect of exogenous DNA in irradiated cells, we performed a number of experiments in which the length of the presence of the restorative agent in the incubation medium was varied, and various combinations of deoxyribonucleosides tested. It is shown in this article that the nucleosides must be present in the growth medium for at least three hours, and that the restorative effect occurs irrespective of the presence or absence of serum in the growth medium. Exogenous DNA revealed the same pattern of the restorative effect with regard to the incubation time after irradiation, but in that case the presence of serum in the growth medium was necessary. Various combinations of deoxyribonucleosides were not equally effective: the restorative effect was observed, except with all four deoxyribonucleosides, only by deoxyadenosine with deoxyguanosine and deoxyguanosine with deoxycytidine. On the basis of the results presented, the possibility of a postreplicative repair is discussed. (auth)

32384 SISTER CHROMATID EXCHANGES INDUCED IN CHINESE HAMSTER CELLS BY UV IRRADIATION OF DIFFERENT STAGES OF THE CELL CYCLE: THE NECESSITY FOR CELLS TO PASS THROUGH S. Wolff, S.; Bodycote, J.; Painter, R. B. (Univ. of California, San Francisco). Mutat. Res.; 25: No. 1, 73-81(Oct 1974).

Experiments on the induction of sister chromatid exchanges (SCE's) by uv light show that, in Chinese hamster cells, these exchanges can be induced in any stage of the cell cycle. The effect is caused by the formation of persistent lesions that lead

to exchanges only if the lesion-bearing chromosomes pass through S. Ultraviolet light can induce exchanges in cell lines that carry out DNA repair replication efficiently as well as in a cell line that shows little or no repair. The induction of SCE's by uv light thus seems to be independent of DNA repair replication. Post-replication repair might be responsible for the formation of the exchanges, but they encompass longer switches of label than have been observed for this type of repair. (auth)

32385 RADIOSENSITIVITY OF T AND B LYMPHOCYTES. P. 2. Effect of Irradiation on Response of T Cells to Alloantigens. Sprent, J. (Basel Univ. (Switzerland). Inst. fuer Immunologie); Anderson, R. E. (New Mexico Univ., Albuquerque (USA). Dept. of Pathology); Miller, J. F. A. P. (Walter and Eliza Hall Inst. of Medical Research, Parkville (Australia)). Eur. J. Immunol.; 4: No. 3, 204-210(Mar 1974).

9 figs.; 1 tab.; 38 refs.

32386 KINETICS OF CELLULAR POPULATIONS IN IRRADIATED SOLID TUMORS. Castellani, A.; Belloni, P.; Arigon, A. (CNEN, Casaccia, Italy). Med. Nucl.-Radiobiol. Lat., Suppl.; 5: No. 5, 31-46(1971). (In Italian).

In the study of the population kinetics of solid tumors the growth curve of the cells may be described as that of an expanding statistical population. Such curves, obtained from volume measurements of the tumor may be interpolated by mathematical functions which allow estimates of the growth rate, of the changes of such rates as a function of time, of the volume doubling time, of the initial tumor volume. However this conservative description of the growth is the result of a complex equilibrium between cell proliferation, cell differentiation and cell loss from the growing tumor mass. It is necessary therefore to evaluate: the mitotic cycle of the proliferating cells; the growth fraction; and the factor of cell loss from the tumor. The action of radiation on solid tumors may be analyzed at different experimental levels. Techniques and data are critically reviewed obtained through measurements of tumor volume; measurements of the loss of reproductive integrity; measurements of cell kinetics and estimates of cell takes in transplantation experiments. The vast amount of knowledge accumulated provides a rational basis for the therapeutic schemes and may be considered as a promising field for applied tumor biology, but its importance in the radio- and chemotherapy of tumors is not yet of practical relevance. (auth)

32387 PHOTOREACTIVATION AND EXCISION REPAIR OF ULTRAVIOLET RADIATION-INJURED DNA IN PRIMARY EMBRYONIC CHICK CELLS. Paterson, M. C.; Lohman, P. H. M.; de Weerd-Kastelein, E. A.; Westerveld, A. (Lab. for Molecular Genetics, Leiden). Biophys. J.; 14: No. 6, 454-466(Jun 1974).

Primary embryonic chick cells were evaluated on the basis of their capacity to repair photochemical lesions produced in the deoxyribonucleic acid (DNA) by ultraviolet (uv) radiation. The fate of one prominent class of uv photoproducts, cyclobutane pyrimidine dimers, was monitored by an in vitro enzymatic assay. UV-irradiated cultures were incubated for prescribed times after which their damaged, radioactive-labeled DNA was extracted and exposed to a purified uv endonuclease selectively active toward sites altered by dimer formation. Single-strand scissions specifically introduced by the enzyme treatment and, therefore, the dimer-containing sites remaining in the DNA were quantified retrospectively by velocity sedimentation in alkaline sucrose. When the chick fibroblasts were incubated in black light, essentially all nuclease-susceptible sites rapidly disappeared from the uv-damaged DNA. In sharp contrast, incubation of the irradiated cultures in total darkness severely impeded the metabolic machinery responsible for site elimination. A substantial amount of uv-stimulated DNA repair synthesis was also detected in the chick cells by conventional techniques involving isopyknic centrifugation and autoradiography. However, the uv photoproducts triggering this indicator of excision repair were probably not dimers since incubation of the irradiated cultures in the light rather than in the dark did not lead to a diminution in the extent of repair synthesis. By these criteria of DNA repair, it appears that embryonic chick cells primarily rely on a highly proficient, light-requiring mechanism, presumably enzymatic photoreactivation, for dimer elimination but also possess a light-independent, excision-type process to cope with other, as yet unidentified, photochemical defects. (auth)

32388 EFFECT OF CAFFEINE ON POSTREPLICATION REPAIR IN HUMAN CELLS. Buhl, S. N.; Regan, J. D. (Univ. of Tennessee, Oak Ridge, TN). Biophys. J.; 14: No. 7, 519-527(Jul 1974).

DNA synthesized shortly after ultraviolet (uv) irradiation of human cells is made in segments that are smaller than normal, but at long times after irradiation the segments made are normal in size. On incubation, both the shorter and the normal segments are elongated and joined by the insertion of exogenous nucleotides to form high molecular weight DNA as in nonirradiated cells. These processes occur in normal human cells, where uv-induced pyrimidine dimers are excised, as well as in xeroderma pigmentosum (XP) cells, where dimers are not excised. The effect of caffeine on these processes was determined for both normal human and XP cells. Caffeine, which binds to denatured regions of DNA, inhibited DNA chain elongation and joining in irradiated XP cells but not in irradiated normal human or nonirradiated cells. Caffeine also caused an alteration in the ability to recover synthesis of DNA of normal size at long times after irradiation in XP cells but not in normal cells. (auth)

32389 ANTIBODY-DEPENDENT CELL-MEDIATED CYTOTOXICITY. III. Two Functionally Different Effector Cells. Scornik, J. C.; Cosenza, H. (Univ. of Chicago). J. Immunol.; 113: No. 5, 1527-1532(Nov 1974).

Macrophages obtained from peritoneal exudate are effector cells for antibody-dependent cytotoxicity. This effector function is independent of phagocytosis, and it is not inhibited by EDTA or aminophylline. Cells functionally similar to those in peritoneal exudate can be obtained from the spleen, but a functionally different population is primarily responsible for cytotoxicity mediated by spleen cells. Effector function of these splenic cells is inhibited by EDTA and aminophylline. These splenic cells tend to adhere to plastic and their function is resistant to a high dose of x-irradiation. (auth)

32390 BIOLOGICAL EFFECTS OF ^{252}Cf NEUTRONS. Fairchild, R. G.; Atkins, H. L.; Drew, R. M.; Robertson, J. S. (Brookhaven National Lab., Upton, NY). Eur. J. Cancer; 10: No. 5, 305-308(May 1974).

From 2nd meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

The biological effects of ^{252}Cf neutrons were studied with cultured cells, and with intact tissues. Measurements available to date, of the relative biological effect (RBE) and of the oxygen enhancement ratio (OER), are summarized and discussed. (auth)

32391 RBE AND OER VALUES AS A FUNCTION OF NEUTRON ENERGY. Hall, E. J. (Columbia Univ., New York). Eur. J. Cancer; 10: No. 5, 297-299(May 1974).

From 2nd meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

A new set of RBE and OER measurements are reported for ten neutron energies between 60 keV and 15 MeV obtained at the Radiological Research Accelerator Facility at Brookhaven National Laboratory. In addition two higher energy neutron beams were studied at the Naval Research Laboratory in Washington and at the Texas A & M Cyclotron. Two biological test systems were used, namely growth inhibition of Vicia seedlings and hamster cells cultured in vitro. In the case of the OER, a minimum value of 1.3 was observed for neutron energies of 220 to 440 keV. OER increased with neutron energy to a maximum of 1.8 for 15 MeV neutrons. A slightly lower value of 1.6 was found to apply to both of the high energy cyclotron-produced neutron beams currently being introduced for radiotherapy. The plot of RBE as a function of neutron energy had a similar shape for both biological test systems employed; the maximum RBE occurred at a neutron energy of about 350 keV. The experimental data were consistent with the theoretical predictions made on the basis of microdosimetric measurements. (auth)

32392 CHARACTERISTICS OF TUMOUR RESPONSES TO DIFFERENT RADIATIONS AND THE RELATIVE BIOLOGICAL EFFECTIVENESS OF FAST NEUTRONS. Barendsen, G. W. (Gezondheidsorganisatie TNO, Rijswijk, Netherlands). Eur. J. Cancer; 10: No. 5, 269-274(May 1974).

From 2nd meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

Responses of tumors to irradiation depend on the intrinsic radiosensitivity of the malignant cells, the oxygenation status of the cells and their kinetics of reoxygenation, variation of the sensitivity in the cell cycle, proliferation of cells in intervals of fractionated treatments and after treatment, and on the presence of non-proliferating cells. The influence of these parameters on the relative biological effectiveness of fast neutrons is discussed. (auth)

32393 EFFECT OF IRRADIATION ON MACROPHAGE MIGRATION INHIBITION. Visakorpi, R. (Univ. of Helsinki). Immunology; 27: No. 1, 145-149(Jul 1974).

Antigen-induced migration inhibition of guinea-pig peritoneal cells was clearly detectable after in vitro irradiation with 5000

to 10,000 rads, but it was weaker than with non-irradiated cells. An attempt was made to quantify this effect by diluting immune cells with non-immune peritoneal cells. The titrations showed a drop of four two-fold dilution steps after 5000 rads and even 2000 rads caused a small drop to 50 per cent efficiency when compared to non-irradiated cells. (auth)

32394 RESPONSE OF CHINESE HAMSTER CELLS TO ^{252}Cf NEUTRONS AND 14 MeV NEUTRONS. Nias, A. H. W. (Glasgow Inst. of Radiotherapeutics, Belvidere Hospital). Eur. J. Cancer; 10: No. 5, 301-303(May 1974).

From 2nd meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

Chinese hamster (ovary) cells were exposed to protracted neutron radiation from ^{252}californium at 15 rad/hr and ^{60}cobalt gamma rays at 100 rad/hr under aerated and hypoxic conditions. The response was also measured to 14-MeV neutrons at 30 rad/min and to 300 kVp x rays at 100 rad/min. Dose-response data were fitted to survival curves and values for oxygen enhancement ratio (OER) were derived by comparison of the exponential slopes of the respective curves. The OER for x rays was 3 : 2; for 14-MeV neutrons 1 : 6; for ^{252}californium 1 : 9, and for ^{60}cobalt 1 : 4. From these values with these mammalian cells it can be concluded that while a change from acute x-irradiation to acute neutron irradiation would reduce the OER by a factor of 2, no advantage due to a reduced OER would be obtained by changing from protracted gamma irradiation to protracted ^{252}californium irradiation. (auth)

Radiation Effects on Microorganisms

Refer also to abstracts 32178, 32358, 32360, 32362, 32363, 32366, 32372, 32373, 32376, and 32477.

32395 (AEC-tr-7571, pp 80-85) FORMS OF INACTIVATION OF YEAST ORGANISMS OF VARIOUS TAXONOMIC GROUPS AFTER IRRADIATION WITH THE GAMMA RAYS OF ^{60}Co. Sokurova, E. N. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 224-228(1974).

The yeast organisms investigated are distributed among four types according to the ratio of forms of inactivation of the cells as a function of the number of divisions after irradiation. The type of death does not depend on the ploidy and the ability of the cells for postradiation recovery. An increase in the fraction of cells that died at the single-celled stage in all the species under conditions of recovery is evidence of inability of the cells to free themselves from this type of damage. (tr-auth)

32396 (AEC-tr-7571, pp 86-95) PRINCIPLES OF THE FORMATION OF RADIORACES IN YEAST ORGANISMS. Communication 4. Dependence of the Yield of Saltants on the Conditions of Postradiation Culturing. Bliznik, K. M.; Kapul'tsevich, Yu. G.; Korogodin, V. I.; Petin, V. G. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 229-236(1974).

The following results were obtained in experiments with diploid yeast Saccharomyces ellipsoideus (vini) strain Megri 139-B, irradiated with the γ rays of ^{60}Co. The decrease in the number of cells forming colonies that do not differ in content of saltant cells from the control under optimum conditions of culturing (30°C, wort-agar) with increasing dose of irradiation is described by a curve possessing the same value of D_0 as the curve of inactivation, but a substantially smaller extrapolation number. When irradiated cells are incubated under nonoptimal conditions (37°C, wort-agar + 7% NaCl), the extrapolation number for the survival curve is lower, while the value of D_0 is approximately the same as in the case of incubation under optimum conditions; moreover, the yield of colonies with an increased content of saltants decreases substantially. Finally, the relative sensitivity to nonoptimal conditions of cells from colonies distinguished by an increased content and variety of saltants, which are formed from yeasts presumed to have sustained a large number of damages during irradiation is significantly higher than in cells arising from yeasts that sustained a small number of damages. The data obtained can be explained by the hypothesis that the death of cells and the appearance of saltants from them are due to monotypic damages, and the more such damages the cell sustains during irradiation, the more often saltants will arise in its progeny and the lower its viability, especially when the conditions of culturing deviate from the optimum. (tr-auth)

32397 (AEC-tr-7571, pp 167-170) RADIOSENSITIZING EFFECT OF N-ETHYLMALEIMIDE ON CELLS OF THREE STRAINS OF CHLORELLA VULGARIS, DIFFERING IN RADIOSENSITIVITY. Apasheva, L. M.; Gusareva, E. V. (Inst. of Developmental Biology, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 287-290(1974).

A distinct radiosensitizing effect on all of the Chlorella strains used was noted in the presence of N-ethylmaleimide. The degree of sensitization depended on the initial radiosensitivity of the cells; the higher their initial radioresistance, the stronger the injurious action of radiation in the presence of N-ethylmaleimide. (ERB)

32398 (CONF-721001-, pp 207-219) RADIOBIOLOGY OF SIMPLE MICROBIAL SYSTEMS. Freifelder, D. (Brandeis Univ., Waltham, MA). 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

This paper summarizes the current state of microbial radiobiology — in particular, what is known about the mechanism of killing by ionizing radiation. The equally important (if not more important) question of mutagenesis is avoided since we have virtually no information concerning this topic. An attempt is made to distinguish what is known with certainty from what is probably true but not yet proved, and the reasons why some experimental approaches have not been profitable are discussed. Some recommendations are made for the future, suggesting the lines of attack which have the greatest probability of yielding a better understanding of the mechanism of inactivation of microorganisms by ionizing radiation. (auth)

32399 THERMORADIATION INACTIVATION OF NATURALLY OCCURRING BACTERIAL SPORES IN SOIL. Reynolds, M. C.; Lindell, K. F.; David, T. J.; Favero, M. S.; Bond, W. W. (Sandia Labs., Albuquerque, NM). Appl. Microbiol.; 28: No. 3, 406-410 (Sep 1974).

Samples of soil collected from the Kennedy Space Center near the spacecraft assembly facilities were found to contain microorganisms very resistant to conventional sterilization techniques. The inactivation kinetics of the naturally occurring spores in soil were investigated by using dry heat and ionizing radiation, first separately and then simultaneously. Dry-heat inactivation kinetics of spores was determined at 105 and 125°C; radiation inactivation kinetics was determined for dose rates of 660 and 76 krads/h at 25°C. Simultaneous combinations of heat and radiation were then investigated at 105, 110, 115, 120, and 125°C, with a dose rate of 76 krads/h. Combined treatment was found to be highly synergistic, requiring greatly reduced radiation doses to accomplish sterilization of the population. (auth)

32400 IS DNA THE ONLY CHROMOSOMAL COMPONENT CONTRIBUTING TO TARGET SIZE FOR MUTATION INDUCTION BY IONIZING RADIATION. Conger, A. D. (Temple Univ., Philadelphia). Mutat. Res.; 25: No. 1, 131-134(Oct 1974).

It appears that the correlation of induced mutation rate with DNA content per cell over a wide range of species cannot be used to establish that DNA alone is the target for induction of mutations by ionizing radiation. The target could be DNA alone; but equally as well it could be total chromatin mass, on the basis of present information. (auth)

32401 DARK RECOVERY OF UV-IRRADIATED PHAGE T1. III. Evidence for Two Modes of Host Cell Repair From Liquid-Holding Experiments. Harm, W. (Univ. of Texas, Dallas). Mutat. Res.; 25: No. 1, 15-24(Oct 1974).

The preceding paper presented evidence that excision repair processes leading to maximal host-cell reactivation (HCR) occur only in a minor fraction of T1-infected cells, in which the repair events are strongly interdependent. The data suggested the existence of a second mode of excision repair, less efficient under usual plating conditions, but occurring in the majority or all of the phages. Work presented in this paper supports this notion. It indicates that the second mode of excision repair becomes maximally efficient when T1-infected cells are held in glucose-buffer at 37° for several hours prior to plating, thereby increasing the survival ("liquid holding recovery"). This is expressed by alteration of the upwardly concave survival curve into a convex curve with no change in the final slope. In particular, the second mode of excision repair has been studied by liquid-holding of the infected cells and subsequent plating in the presence of 2 mg/ml caffeine, which completely inhibits HCR on the plate. Our data show that in glucose-buffer (without or with chloramphenicol up to 400 μg/ml) excision repair proceeds through the caffeine-inhibitable step(s), resulting in repair events which occur equally in all complexes and affect lesions independently of one another. Such repair is completely absent if also the holding-buffer contains 2 mg/ml caffeine. In buffer containing only 0.2 mg/ml caffeine or in preirradiated host cells the rate of repair is considerably decreased, affecting — in contrast to non-liquid-holding conditions — all complexes and all lesions equally in a random fashion. No liquid-

holding recovery is observed when uv-irradiated TI is v-gene-reactivated, i.e., repaired in excision-repair-deficient cells by superinfection with T4v$^+$ phage. (auth)

32402 TIME SCALE FOR REJOINING OF BACTERIOPHAGE λ DEOXYRIBONUCLEIC ACID MOLECULES IN SUPERINFECTED pol$^+$ AND polA1 STRAINS OF ESCHERICHIA COLI AFTER EXPOSURE TO 4 MeV ELECTRONS. Boye, E.; Johansen, I.; Brustad, T. (Norwegian Radium Hospital, Montebello). J. Bacteriol.; 119: No. 2, 522-526(Aug 1974).

The time scale for rejoining of radioinduced deoxyribonucleic acid (DNA) single-strand breaks was measured in the presence and absence of oxygen. The involvement of DNA polymerase I in this repair process was studied. Formation and rejoining of DNA strand breaks were measured in λ DNA infecting lysogenic pol$^+$ and polA1 strains of Escherichia coli irradiated by 4 MeV electrons under identical conditions. Irradiation and transfer to alkaline detergent could be completed in less than 180 ms. The initial yields of DNA strand breaks were identical in pol$^+$ and polA1 host cells and four- to fivefold higher in the presence of oxygen than in nitrogen anoxia. Evidence for the existence of a very fast repair process, independent of DNA polymerase I, was not found, since no rejoining of radiation-induced DNA strand breaks was observed during incubation from 45 ms to 3 s. In pol$^+$ host cells most of the strand breaks produced in the presence of oxygen were rejoined within the first 30 to 40 s of incubation, whereas no rejoining could be detected within the same period of time in anoxic cells. Since no rejoining of broken λ DNA molecules was observed in polA1 host cells, it is concluded that the synthetase activity of DNA polymerase I is involved in the rejoining of DNA breaks induced by radiation in the presence of oxygen. (auth)

32403 EFFECT OF PREIRRADIATION RIBONUCLEIC ACID SYNTHESIS INHIBITION ON RESISTANCE TO ULTRAVIOLET LIGHT WITH RESISTANT AND SENSITIVE STRAINS OF ESCHERICHIA COLI B/r. Rude, J. M.; Doudney, C. O. (Albert Einstein Medical Center, Philadelphia). Contract AT(11-1)-3095. J. Bacteriol.; 119: No. 1, 123-128(Jul 1974).

The ultraviolet resistance of a streptolydigin-susceptible strain of Escherichia coli B/r hcr$^-$ increased during preirradiation treatment with streptolydigin (an inhibitor of deoxyribonucleic acid-dependent ribonucleic acid polymerase) for 20 min and then remained constant. During preirradiation treatment with chloramphenicol (an inhibitor of protein synthesis), resistance to ultraviolet light increased for 1 to 2 h, and reached a maximal level significantly above that attained in streptolydigin-containing medium. These results suggest that there are two mechanisms that function in Hcr$^-$ cells during chloramphenicol treatment which contribute to the concomitant ultraviolet resistance enhancement. One is ribonucleic acid dependent and is inhibited by streptolydigin. This ribonucleic acid-dependent mechanism appears to be absent in wild-type and RecA E. coli B/r strains. (auth)

32404 INHIBITION OF REPLICATION GAP CLOSURE IN ESCHERICHIA COLI BY NEAR-ULTRAVIOLET LIGHT PHOTOPRODUCTS OF L-TRYPTOPHAN. Yoakum, G.; Ferron, W.; Eisenstark, A.; Webb, R. B. (Argonne National Lab., IL). J. Bacteriol.; 119: No. 1, 62-69(Jul 1974).

Near-ultraviolet photoproducts of L-tryptophan (TP) differently inhibited deoxyribonucleic acid (DNA) replication in wild-type cells and uvrA, polA1, and recA recB double mutants of Escherichia coli. Wild-type cells labeled in their DNA with [^{3}H]thymidine in the presence of TP produced small pieces of DNA (7×10^6 daltons), which corresponded in size to late replicative intermediates of discontinuous DNA synthesis. Moreover, when TP was present, it took five times longer to chase the low-molecular-weight DNA pieces into high-molecular-weight DNA. The observation of replicative intermediates in the presence of TP, and their slow chase into high-molecular-weight DNA in the presence of TP, is strong evidence that TP stabilizes replication gaps in E. coli DNA. Although TP slowed DNA replication in wild-type cells, this effect was transient and DNA synthesis eventually resumed at a normal rate. However, in polA1 and recA recB mutants, DNA synthesis was completely inhibited. Determinations of size and total counts of cells incubated in TP suggested that TP uncouples cell division from DNA replication in recA recB mutants, whereas these processes remain coupled in wild-type cells and in uvrA and polA1 mutants. The slow chase of TP-stabilized pieces of DNA in the presence of TP suggested that the selective effect of TP on DNA synthesis and viability in repair-deficient mutants is a result of TP inhibition of replication gap closure. (auth)

32405 ROLE OF THE PHILL PHAGE GENOME IN COMPETENCE OF STAPHYLOCOCCUS AUREUS. Sjoestroem, J. E.; Philipson, L. (Uppsala Univ.). J. Bacteriol.; 119: No. 1, 19-32(Jul 1974).

Both phage φ11 and 83A, when present as prophage or when used as helper phage, induce competence for transfection and transformation to the same level in Staphylococcus aureus, strain 8325-4. Cells lysogenized with certain temperature-sensitive (ts) mutants of phage φ11 show competence at the nonpermissive temperature (41 C) without production of infectious phages. Phage φ11ts allele 31 can neither as a prophage nor as a helper phage develop competence under nonpermissive conditions. This mutant appears, therefore, to be mutated in the region of the phage genome controlling competence. The competence level for both transfection and transformation is increased by superinfecting strain 8325-4 (φ11) or 8325-4 (83A) at high multiplicities with phage φ11 with some of its mutants or with phage 83A. This superinfection enhancement appears to require protein synthesis but not deoxyribonucleic acid synthesis as judged from studies with inhibitors of macromolecular synthesis. Besides the phage particle, no extracellular or cell-bound factors so far detected can induce competence. The phage-induced product conferring competence is rapidly synthesized by strain 8325-4 (ts$\phi 11_{31}$) after shift to permissive conditions, but requires deoxyribonucleic acid and protein synthesis to be expressed. Recombination between the sus mutants of phage φ11 of Kretschmer and Egan and ts$\phi 11_{31}$ indicate that competence is controlled by an early gene in the lytic cycle which may be expressed also in lysogenic cells. The phage product inducing competence appears to have a half-life of 10 to 15 min in the conditional lethal mutant at shift to nonpermissive temperature. Ultraviolet inactivation of phage φ11 infectivity occurs more rapidly than inactivation of competence induction. In fact, the number of transformants is increased at low doses of irradiation. Competence induction is, however, decreased at high doses of ultraviolet irradiation. (auth)

32406 GENETIC ANALYSIS OF A TEMPERATURE-RESISTANT REVERTANT OF THE CONDITIONAL LETHAL ESCHERICHIA COLI DOUBLE MUTANT polA12 uvrE502. Smirnov, G. B.; Saenko, A. S. (Inst. for Epidemiology and Microbiology, Moscow). J. Bacteriol.; 119: No. 1, 1-8(Jul 1974).

Conditional lethality of the Escherichia coli polA12 uvrE502 double mutant may be overcome by a mutation that has been termed polA350. The polA350 mutation restored the polymerizing activity of deoxyribonucleic acid polymerase I at 42 C in the polA12 mutant and partially suppressed ultraviolet (uv) and methylmethane sulfonate sensitivities of the polA12. Mapping experiments have located polA350 between metE and polA12, very close to the latter. The strain carrying polA12polA350 and recB21 was viable at 42 C. The effects of the recB21 and polA12polA350 combination on the uv sensitivity were additive. The triple mutant polA12polA350uvrE502 was more uv sensitive than the single uvrE502 mutant. (auth)

32407 VARIATIONS IN UV-INDUCED LETHALITY AND "PETITE" MUTAGENESIS IN SYNCHRONOUS CULTURE OF SACCHAROMYCES CEREVISIAE. P. 1. Influence of Post-Irradiation Conditions. Chanet, R.; Heude, M. (Institut du Radium, 91-Orsay (France)). Mol. Gen. Genet.; 131: No. 1, 21-26(1974). 2 figs.; 20 refs.

Cells of Saccharomyces cerevisiae taken at different stages of the mitotic cell cycle exhibit a variation to lethality and "petite" mutation following uv irradiation. The magnitude of the variations encountered for lethality is diminished when the cells are dark held, the maximum liquid holding recovery taking place during G1 phase and the minimum in G2 phase. Liquid holding treatment, on the contrary, increases the magnitude of cyclic variations of "petite" induction. The illumination of irradiated cells promotes an increase in survival and a restoration of a proportion of "grande" cells at all cell stages. However, variations are maintained and the ratio between maximum and minimum resistance is approximately the same. (auth)

32408 CONTENT OF ALDEHYDES IN VEGETABLE EXTRACTS DURING GAMMA IRRADIATION. Norbaev, N. (Termez State Pedagogical Inst., USSR). Uzb. Biol. Zh.; No. 3, 22-24 (1974). (In Russian).

The formation of materials with $E_{\frac{1}{2}} = -1.46$ V of root extracts of corn and yeast cells having aldehydes was detected by polarographic and other methods. At doses of 10 kR the quantity of aldehydes is increased in the corn extracts by a factor of 2 and in the yeast cells at doses of 100 kR by a factor of 1.7 to 1.8. (tr-auth)

32409 DNA SYNTHESIS AND ULTRAVIOLET SENSITIVITY DURING THE CELL CYCLE OF ESCHERICHIA COLI. Kelley, M. S. Dallas, TX; Univ. of Texas (1974). 123p. University Microfilms Order No. 74-20,476.

Thesis (Ph. D.).

Bacterial cultures were synchronized by the Helmstetter filter-elution technique or the Cutler-Evans stationary phase method. The DNA synthesis (S) period was determined in synchronous

cultures of succinate grown cells by measuring incorporation of tritium labeled DNA precursor as well as total DNA content. The S period was found to occur late in the interdivisional period of both K-12 and B/r strains. These findings were contrary to the Cooper-Helmstetter model based on the assumption (which we find to be incorrect) that the membrane procedure delivers new born cells immediately after their division. Finally, variations in uv sensitivity, measured as colony forming ability, were determined during the cell cycle. Repair proficient bacterial strains (B/r and B/r301) were found to have an age response to uv similar to the one described using mammalian cells. Maximum sensitivity occurred after completion of the gap (G1 in mammalian cells) period and decreased to a minimum at the completion of the S period. In an attempt to determine what role repair processes had in such an age response, bacterial mutants deficient in excision resynthesis repair (ERR^-) and/or recombination (REC^-) repair were studied. (These two repair processes are operationally similar to processes observed in mammalian cells after exposure to uv.) ERR^- strains (AB2437, uvrA and B/r HCR^-, uvrA) showed age dependent variations in sensitivity to uv, but, in contrast to the response of repair proficient strains, maximal sensitivity occurred during the gap period and decreased to a minimum during the S period. REC^- strains (F1, recA; JC7505, recA recB; and AB2480, uvrA recA) showed no detectable variation in uv sensitivity during the cell cycle. The results with repair deficient, ERR^-REC^- (AB2480, uvrA recA) cells indicates that repair has a role in the response observed with wild type cells. However, it is not possible to reconstruct the wild type response by simply summing the responses of the single repair deficient mutants (ERR^- or REC^-). It is probable that other factors (e.g., effect of uv or initiation of DNA synthesis and rate of replication) are also involved. (Diss. Abstr. Int., B)

32410 LINKAGE ANALYSIS IN DICTYOSTELIUM DISCOIDEUM USING TEMPERATURE-SENSITIVE GROWTH MUTANTS SELECTED WITH BROMODEOXYURIDINE. Kessin, R. H.; Williams, K. L.; Newell, P. C. (Oxford Univ.). J. Bacteriol.; 119: No. 3, 776-783(Sep 1974).

Amoebae of the cellular slime mold Dictyostelium discoideum grown in the presence of bromodeoxyuridine are killed on exposure to near-ultraviolet light. By using this phenomenon, a method was devised by which mutants of D. discoideum that are temperature-sensitive for growth can be readily obtained. Three such mutants have been characterized genetically and each was found to be associated with a different linkage group. Two of these linkage groups have not previously been described. (auth)

32411 PHOTOREACTIVATION OF UV-INDUCED DIVISION DELAY IN AN ALBINO MUTANT OF BLEPHARISMA JAPONICUM. Smith, E. M. Stanford, CA; Stanford Univ. (1974). 101p. University Microfilms Order No. 74-20,235.

Thesis (Ph. D.).

Albino B. japonicum and red B. stoltei were photoreactivated by yellow and orange or red (greater than 570 nm) light. (The other Blepharisma types were not tested.) Light exposures that included near-uv (350-525 nm) light at low doses or visible (525-610 nm) light at higher doses was not photoreactive for the albino mutant of B. japonicum. Highly photoreactivating light exposures had no effect on the onset of first division of non-uv-irradiated albino B. japonicum. Supra-optimal light exposures resulting in decreased PR produced division delays when given to non-uv-irradiated albino B. japonicum. Blepharisma's ability to resist the damaging effect of medium intensity (50 ergs mm^{-2} sec^{-1}) visible light (greater than 525 nm), expressed as the dose blepharismas could receive before PR was reduced to half maximal, was roughly proportional to their degree of pigmentation. In the light of the present study, the previously reported low degree of PR of far-uv-induced division delay, which had been considered exeptional among the ciliates, appears to be an artifact—a result of use of logarithmic phase cultures which show less PR, exposure to yellow light after far-uv irradiation, which did not induce PR in other protozoans, but which is effective for PR in Blepharisma, and supra-optimal PR light exposure to wavelengths which induce division delay. The exceptional aspects of PR in Blepharisma include a peculiar action spectrum not found in other cells as indicated by the PR activity of yellow (577 nm) light which is ineffective elsewhere. The limitation of PR activity to longer wavelengths than in other cells may result from the sensitivity of Blepharisma to near-uv and short wavelength visible light resulting in division delay, perhaps at the same time PR is occurring but is masked. (Diss. Abstr. Int., B)

32412 INCREASED RADIATION RESISTANCE OF VEGETATIVE BACILLUS PUMILUS. Parisi, A.; Antoine, A. D. (Rutgers-The State Univ., New Brunswick, NJ). Appl. Microbiol.; 28: No. 1, 41-46(Jul 1974).

A 4.5-fold increase in vegetative cell radiation resistance of Bacillus pumilus E601, the internationally recognized biological standard for irradiation sterilization, was obtained by the repeated passage of resistant survivors through successive sublethal doses of ^{60}Co irradiation. This increase in resistance was accompanied by a corresponding increase in spore resistance through the seventh irradiation passage. By the fifteenth passage, the ability for spore formation was lost. Other effects noted by the successive irradiation dosages included loss of motility and pellicle formation, and changes in the Gram reaction, cell morphology, and colonial morphology. Increased resistance was also accompanied by an increased nutritional requirement for specific amino acids. Radiation resistance was not transferred from vegetative cells to spores. (auth)

32413 RESPONSE OF MYCOBACTERIUM AVIUM TO ULTRAVIOLET IRRADIATION. McCarthy, C. M.; Schaefer, J. O. (New Mexico State Univ., Las Cruces). Appl. Microbiol.; 28: No. 1, 151-153(Jul 1974).

The survival response of Mycobacterium avium to ultraviolet irradiation demonstrated the presence of a photoreactivating repair system. Graphs are presented to show kinetics of photoreactivation. (HLW)

32414 FATE OF DONOR DEOXYRIBONUCLEIC ACID IN A HIGHLY TRANSFORMATION-DEFICIENT STRAIN OF HAEMOPHILUS INFLUENZAE. Kooistra, J.; Venema, G. (Univ. of Groningen, Netherlands). J. Bacteriol.; 119: No. 3, 705-717(Sep 1974).

A transformation-deficient strain of Haemophilus influenzae (efficiency of transformation 10^4-fold less than that of the wild type), designated TD24, was isolated by selection for sensitivity to mitomycin C. In its properties the mutant was equivalent to recA type mutants of Escherichia coli. The TD24 mutation was linked with the str-r marker (about 30%) and only weakly linked with the nov-r2.5 marker. The uptake of donor deoxyribonucleic acid (DNA) was normal in the TD24 strain, but no molecules with recombinant-type activity (molecules carrying both the donor and the resident marker) were formed. In the mutant the intracellular presynaptic fate of the donor DNA was the same as that in the transformation-proficient (wild-type) strain, and the radioactive label of the donor DNA associated covalently with the recipient chromosome in about the same quantity as in the wild type. However, many fewer donor atoms were associated with segments of the mutant's recipient chromosome as compared with segments of the wild-type chromosome. In the mutant the association was accompanied by complete loss of donor marker activity. The lack of donor marker activity of the donor-recipient complex of DNA isolated from the mutant was not due to lack of uptake of the complex by the second recipient and its inability to associate with the second recipient's chromosome. Because the number of donor-atom-carrying resident molecules was higher than could be accounted for by the lengths of presynaptic donor molecules, the idea that the association of donor DNA atoms with the mutant chromosome results from local DNA synthesis rather than from dispersive integration of donor DNA by recombination is favored. (auth)

32415 GENETIC MAPPING IN BACILLUS SUBTILIS BY 5-BROMOURACIL SENSITIZATION TO ULTRAVIOLET INACTIVATION OF TRANSFORMING ACTIVITIES. Matsumoto, K.; Shibata, T.; Saito, H. (Tokyo Univ.). J. Bacteriol.; 119: No. 3, 666-671(Sep 1974).

A new method for chromosome mapping of Bacillus subtilis Marburg is presented which is based on the sensitization to ultraviolet irradiation of transforming deoxyribonucleic acid that has incorporated 5-bromouracil instead of thymine. Deoxyribonucleic acid was extracted at intervals from the outgrowing spores of a thymine-requiring mutant incubated with 5-bromodeoxyuridine and subjected to a definite dose of ultraviolet irradiation. The residual activities of various genetic markers were assayed by transformation. The marker activity of deoxyribonucleic acid that had incorporated 5-bromodeoxyuridine was approximately 10 times as sensitive to ultraviolet irradiation as that of normal deoxyribonucleic acid. The markers proximal to the replication origin were sensitized at earlier times of outgrowth than distal markers. The chromosome replication in outgrowing spores was sufficiently synchronous and allowed the definite determination of when a marker became sensitized by incorporation of 5-bromodeoxyuridine. The time, designated sensitization time, was estimated by plotting the logarithmic values of relative residual activities versus incubation times. The map constructed with sensitization times as a measurement showed good agreement with those constructed by other methods. The replication of the chromosome under the described conditions appeared to occur in the following marker order: (purA, hisA)-(purB)-(thr, pyrA)-(metC)-(leuA)-(lys, trpC, metB). (auth)

32416 INFLUENCE OF OXYGEN ON THE INDUCTION OF MUTATIONS IN BACTERIOPHAGE PHI X 174 BY IONIZING RADIATION. Bleichrodt, J. F.; Verheij, W. S. D. (Rijksverdedigingsorganisatie, TNO, Rijkswijk, Netherlands). Int. J. Radiat. Biol.; 25: No. 5, 505-512(May 1974).

Several mutants of bacteriophage ΦX174 having nonsense codons in different cistrons are reverted with a higher efficiency to pseudo wild-type particles, i.e. particles able to propagate in suppressorless host bacteria, when irradiated with γ rays in the presence of oxygen than when irradiated under anoxic conditions. For an ochre mutant of ΦX174 it was found that the radiation-induced conversion into an amber mutant, which corresponded with a transition of adenine in the parental DNA into guanine in the progeny DNA, was enhanced by oxygen. Differences between amber mutants of more than two-hundred fold in the efficiency of induction of pseudo wild-types showed that the local environment of the amber codon in the phage particle exerted a great influence on the induction. (auth)

Radiation Effects on Plants

Refer also to abstracts 32391, 32400, 32408, and 32477.

32417 (AEC-tr-7571, pp 125-130) INVESTIGATION OF THE RADIOSTIMULATION EFFECT IN TOMATOES. Daskalov, Kh.; Maltseva, S. (Inst. of Genetics and Plant Selection, Sofia). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 257-260(1974).

Preplanting irradiation of dry seeds of Pioner-2, Druzhba, and Achi tomatoes with the γ rays of ^{60}Co, at doses of 1500 to 2500 R were shown to stimulate the overall development of the plants, early ripening (up to three to four harvests) and an increase in the number of fruits. The greatest stimulating effect is manifested for the variety Pioner-2. No difference is observed in the average weight of the fruit, seed content of the fruits, chemical composition and taste qualities of the fruits. The optimum doses of irradiation are 1500 and 2000 R at a dose rate of 36 R/min. (tr-auth)

32418 (ANL-8060(Pt.3), pp 180-185) RADIATION-INDUCED SEMIDORMANCY IN RED PINE. Jordan, C. F. 1973.

In Radiological and Environmental Research Division annual report, January-December 1973.

Most plants enter a state of dormancy or semidormancy when subjected to various environmental stresses. Under conditions of cold or drought, many of the physiological functions of plants, including respiration, slow down. Exposure of plants to winter conditions such as short day length, low temperatures, low availability of soil water and nutrients induces dormancy, which protects plants against these deleterious conditions. Data are presented that show that in a relatively narrow zone of γ radiation between the lethal level and the levels at which repair processes cause respiration to be high, respiration of red pine (Pinus resinosa Ait.) is relatively low, yet the plants exhibit no die-back, indicating a state of reduced metabolic activity which appears to have survival value for highly stressed plants. Evidence of physiological adaptation to chronic γ radiation has not been previously reported. The field work was carried out in a γ radiation field. (CH)

32419 INFLUENCE OF DOUBLE HEAT-TREATMENT ON RADIATION DAMAGE OF CREPIS CAPILLARIS SEEDS. Atayan, R. R.; Avakyan, H. M.; Kagramanyan, R. S. (Erevan Physical Inst.). Stud. Biophys.; 43: No. 1, 69-72(1974).

An attempt was made to investigate a possible interaction of the effects of pre- and posttreatment of seeds with heat on radiation damage to chromosomes. Dormant seeds of Crepis capillaris were heat-treated—100°C for 30 minutes—prior to and/or after exposure to different doses of x rays. Radiation and combined treatment effects were measured in terms of chromosome aberrations in root tip metaphase cells passing the first mitosis. The data obtained suggest that preirradiation heat-treatment of seeds protects them against the damaging effect of postirradiation heat-treatment. The protection is most pronounced when heating directly precedes irradiation, and is markedly reduced if irradiation is delayed a week. The present study extends the knowledge of the influence of temperature on radiosensitivity of seeds. (auth)

32420 INVESTIGATIONS ON THE RADIOPROTECTIVE EFFECT OF CYSTEINE AND SPERMINE IN MITOSES OF ROOT TIP VICIA FABA. Laumann, G. Bonn, Ger.; Bonn Univ. (1971). 70p. (In German). INIS.

Thesis. 18 figs.; 6 tabs.; 67 refs. With abstract. Available from the library of the Bonn Univ.

The roots were exposed to x radiation at 500 and 750 R. Treatment with chemicals took place before or after irradiation. The radiation damages occurring (decrease of the mitotic frequency and nucleus anomalies) were reduced by the protective medium. With pre- and post treatment, cysteine achieved at 500 R a 100% protection of the mitotic frequency. When irradiated with 750 R, the mitotic frequency could be normalized merely by pretreatment. Spermine also exhibited a 100% protection with treatment prior to irradiation with 500 R concerning the mitotic frequency, however the effect decreased with post treatment. No 100% protection was achieved as regards the nuclear damage. A residual damage of about 35% was visible with the pretreatment as well as with the post treatment with cysteine. Spermine showed a very good protective effect with pretreatment, only 20% residual damage remained after an optimal spermine treatment. With post treatment the value was about twice as high. Quantitative determinations showed that cysteine penetrates into the root tissue corresponding to the length of the induction period. With long periods of induction a lot of cysteine can be detected in the cells and with short periods, correspondingly little. The amount of cysteine is increased by the irradiation. The increase takes place in the manner that the amount of cysteine already present sets the quantity to be produced. If the cysteine content in the root tips is sufficiently high, then the cysteine formation is reduced. Furthermore, the radiation dose influences the cysteine production, the higher radiation dose leads to the greater formation of cysteine. The interpretation is that due to the increase in the quantity of cysteine, the intracellular protective potential in the tissue is raised. (GE)

32421 VEGETATION CHARACTERISTICS OF LENS ESCULENTA (MOENCH) FOLLOWING IRRADIATION WITH THERMAL NEUTRONS. Uhlik, J. (Univ. of Agriculture, Prague-Suchdol, Czech.). Sb. Vys. Sk. Zemed. Praze, Fak. Agron., Rada A; No. 1, 127-143(1972). (In Czech).

Preliminary findings are presented on the effect of thermal neutrons on generation M_1 of the lentil (Lens esculenta). The study aimed at finding the range of efficient doses of thermal neutrons that had not so far been investigated in view of their biological effect. Also the variability was observed of various vegetation characteristics due to the conditions of the site during five seasons with extremely different climatic conditions. Doses between 8×10^{11} n/cm^2 and 5×10^{12} n/cm^2 did not considerably affect the number of germinated seeds related to controls. In a greenhouse, doses of about 10^{12} n/cm^2 to 3.3×10^{12} n/cm^2 resulted in a decrease in the number of sprouted plants, in dependence on the manner of cultivation. The growth of roots was found to be already inhibited by a dose of 6.5×10^{11} n/cm^2. Thermal neutron irradiation was also found to affect the length of the plants. The greatest differences were observed on the 35th day after irradiation, the smallest on the 90th day. Climatic factors were observed to affect considerably the length of stems, the number of surviving plants, and the fertility of the plants. The range of practical and useful doses was ascertained to be limited to doses of 1.5×10^{12} n/cm^2 and 5×10^{12} n/cm^2, depending on the conditions of cultivation. Under less suitable cultivation conditions a dose of 5×10^{12} n/cm^2 was found lethal, while under good conditions only a dose of 6×10^{12} n/cm^2 was observed to show the same effect. (Nuclear Sci. Abstr. Czech.)

32422 RESISTANCE TO USTILAGO MAYDIS OF WD LINEAGE PROGENY AFTER CHRONIC GAMMA IRRADIATION. Rousek, J. (Univ. of Agriculture, Prague-Suchdol, Czech.). Sb. Vys. Sk. Zemed. Praze, Fak. Agron., Rada A; No. 2, 105-111 (1972). (In Czech).

The effect of chronic gamma irradiation on the sensitivity of maize to smut (Ustilago maydis) was studied in 58 progenies I_4 of the WD lineage maize infested with smut. Part of the progenies were irradiated in a γ field in generation I_1. The differences were statistically processed. The irradiation was found to result in greater differences between the original offspring generation and generation M_4 than in the controls as far as the resistance to smut was concerned. Inbreeding was not found to affect the resistance. (Nuclear Sci. Abstr. Czech.)

32423 POSSIBLE BIOCHEMICAL MECHANISMS OF RADIOSTIMULATION OF LIVING CELLS. Ehrenberg, L.; Naeslund, M. (Stockholm Univ. (Sweden). Radiobiologiska Institutionen); Fedorcsak, I. (Eotvos Lorand Tudomanyegyetem, Budapest (Hungary). Inst. of Genetics). Stimulation Newslett.; No. 5, 1-14(Dec 1973).

1 fig.; 1 tab.; 16 refs.

Stimulation in crops recently gained increased interest because of the possibility of increasing yield by a cheap process without contributing to the load of environmental chemicals. A main difficulty is the irregularity of the effect. An understanding of the mechanism would permit the interpretation of these irregularities and a more reliable practical use. Therefore, certain ideas on the possible biochemical mechanisms for a radiostimulation are presented and it is demonstrated that a stimulation in the

meaning of increased metabolic activity and proliferation can be induced experimentally. (GE)

32424 THE DEFINITION AND STATISTICAL EVALUATION OF RADIATION STIMULATION. Ernst, D. (Technische Univ. Hannover (F. R. Germany). Inst. fuer Biophysik; Gesellschaft fuer Strahlen- und Umweltforschung m. b. H., Hannover (F. R. Germany). Inst. fuer Strahlenbotanik). Stimulation Newslett.; No. 5, 15-26(Dec 1973).

5 figs.; 6 refs.

At first, a general definition is given for the term "stimulation" and two typical dose-effect curves, one with and one without stimulation, are presented. A quantitative definition of stimulation is proposed, which is then tested for significance. An attempt is made to give a formula for the practical application of the definition and the optimum dose. (GE)

32425 A STUDY ON RADIO-STIMULATION EFFECT IN TOMATO, PEPPER AND EGGPLANT. Daskaloff, C.; Malceva, S. (Sofia Univ. (Bulgaria). Inst. of Genetics and Plant Breeding). Stimulation Newslett.; No. 5, 27-36(Dec 1973).

1 fig.; 5 tabs.; 5 refs.

Dry seeds were irradiated with 50 to 3000 R of ^{60}Co γ rays and sown in boxes, immediately after irradiation. The experiments were carried out in greenhouses and in the open field. In the case of tomatoes and eggplants, controls emerged 1 to 2 d earlier than the irradiated ones, but the irradiated plants grew more quickly and vigorously. They were earlier in flowering and fruit setting. In contrast to this, the irradiated and control pepper plants were found to emerge simultaneously. Differences were observed in the flowering stage and with time of ripening, where the irradiated plants surpassed the controls. In all cases the fruit number per plant was greater for the irradiated plants. (GE)

32426 STUDIES ON THE EFFECT OF PRE-SOWING IRRADIATION WITH LOW DOSES OF GAMMA RAYS ON SEEDS OF COMMON WINTER WHEAT. Djelepov, K. (Institute for Wheat and Sunflower, Tolbouhin (Bulgaria)). Stimulation Newslett.; No. 5, 37-42(Dec 1973).

1 tab.; 17 refs.

In a 3-year experiment, seed irradiation was preformed with 500, 1000, and 2000 R of γ rays at a dose rate of 108, 141, and 125 R/min. Two days after irradiation the seeds were sown. Observations were carried out on germinability, overwintering, heading and tillering, height of mature plants, length and number of spikelets and grains of the leading ear, weight of 1000 kernels and of a hectolitre. No significant differences were found between plants grown from irradiated and non-irradiated seeds as far as germination and shoot development are concerned. Grain yields varied in wide range, but higher yields were obtained in 2 years from seeds irradiated with 500 or 1000 R. (GE)

32427 RADIATION STIMULATION OF GERMINATION IN DORMANT COCKLEBUR (XANTHIUM STRAMONIUM) SEEDS. Mathew, T.; Gaur, B. K. (Bhabha Atomic Research Centre, Bombay (India). Biology and Agriculture Div.). Stimulation Newslett.; No. 5, 43-47(Dec 1973).

2 tabs.; 11 refs.

Dormant seeds were irradiated with 1 to 250 kR of ^{60}Co γ rays at a dose rate of 3 x 2 kR/min and sown immediately in petri dishes. The seeds were irrigated regularly and maintained at 25°C. One series was kept in dark, the other one received 12 hrs light per day. Protrusion of radicle out of the seed was used as criterion of germination. Light was found to improve the germination rate in non-irradiated control seeds. The extent of radioinduced stimulation was dependent on the radiation dose. Further, a synergism between radiation and light was found. (GE)

32428 EFFECT OF LOW DOSES OF RADIATION ON TOMATO SEEDLINGS. Vasti, S. M. (Atomic Energy Agricultural Research Centre, Tandojam (Pakistan)). Stimulation Newslett.; No. 5, 48-51(Dec 1973).

1 tab.; 11 refs.

Tomato seedlings were irradiated with 0.5, 1, and 2 kR of ^{60}Co γ radiation. The roots were given proper shielding during the course of treatment. The seedlings were transplanted in field. After 50 d plant height, number of branches and trusses were recorded. The results indicate a radiation damage as shown by the late emergence of vegetative and floral buds, and no stimulation was observed. (GE)

32429 INTRODUCTION INTO AGRICULTURAL PRACTICE OF PRE-SOWING GAMMA-IRRADIATION OF SEEDS USING THE PRODUCTION-MODEL GAMMA INSTALLATION KOLOS. Berezina, N. M.; Kuzin, A. M.; Kaushanskii, D. A. At. Energ. (USSR); 37: No. 1, 43-51(Jul 1974). (In Russian).

A theoretical explanation for the stimulating action of radiation and its mechanism are presented. A review of the results of pre-sowing gamma irradiation of seeds is given. The results of laboratory and field tests, in which the role of modifying factors is established, are presented. On the basis of these data, recommendations providing for stability of action of stimulating radiation doses were worked out. The results of three years of tests with pre-sowing irradiation in Moldavia, Kazakhstan and Kirghizia, showing that it is possible to raise the yields of various crops from 7.3 to 20%, are presented. This technique has been introduced on a wide scale in the aforementioned Republics. (auth)

32430 EFFECT OF X-IRRADIATION ON THE SIZE OF THE MUTATED SECTOR IN DIPLOID AND TETRAPLOID RICE. Sree Rangasamy, S. R.; Sree Ramulu, K. (Tamilnadu Agricultural Univ., Coimbatore (India). Dept. of Biology). Theor. Appl. Genet.; 44: No. 6, 266-269(1974).

5 tabs.; 19 refs.

An investigation was carried out of the effect of x-irradiation on the size of the mutated sector in three diploids (A.S.D.8, T.N.1 and G.E.B.24) and the autotetraploid of G.E.B24 of Oryza sativa L., by analyzing the M_2 segregation ratios of chlorophyll mutants. Of 573 segregating M_1 panicles analyzed by χ square test in the diploids, 206 showed good fit with a 3:1 ratio, while the rest of the progenies (367) deviated significantly in both directions from the expected 3:1 segregation. This was interpreted as the result of M_1 panicles developing from both single cell and multicellular initials following x-irradiation, the former segregating for 3:1, the latter significantly deviating from 3:1. An assessment of fertility (as judged from the number of M_2 seedlings per mutated M_1 panicle), related to the distribution of χ square deviations from the 3:1 ratio in the diploids, indicated that the M_1 panicle progenies deriving from single cell initials had low fertility but those originating from multicellular initials ranged from low to high fertility. A comparison of the distribution pattern of the M_2 segregation ratios of chlorophyll mutant phenotypes in the diploid and autotetraploid G.E.B.24 indicated that, in the tetraploid, a larger sector and only one, or fewer cell initials than in the diploid species, are involved. (auth)

32431 GAMMA-RADIATION INDUCED VARIATION IN SOME MORPHOLOGICAL AND NUTRITIONAL COMPONENTS OF CICER ARIETINUM L. CV. CHHOLA. Mujeev, K. A. (Atomic Energy Agricultural Research Centre, Tandojam, Pakistan). Experientia; 30: No. 8, 891-892(15 Aug 1974).

Seeds of chick peas were gamma-irradiated in doses of 1 to 10 kR. Results showed that there were no adverse effects on nutritional qualities. Germination and seedling height were recorded 15 days after 50% germination was observed in controls. Data indicated that germination and seedling height were stimulated as a consequence of seed irradiation. (HLW)

32432 RBE VARIATIONS FOR HIGH-ENERGY ELECTRONS. Aasard, P. E. (Karolinska Sjukhuset, Stockholm). Acta Radiol., Suppl.; No. 310, 9-28(1971).

The biologic effect of 15-MeV high energy electrons at different depths in a phantom were investigated with barley seeds as biologic material. A chemical dosimetric system was also used in order to investigate changes in LET with depth in a phantom for the same electron beam. A comparison of the biologic effects in barley seeds with different moisture contents was made with high energy electrons and ^{60}Co gamma radiation. The results are discussed with emphasis on the role of energy transfer to the hydration shells of macromolecules. (auth)

Radiation Effects on Animals

Refer also to abstracts 32376 and 32380.

Man

Refer also to abstracts 32023, 32024, 32058, 32062, 32069, 32086, 32200, 32392, 32568, 34463, 34464, and 34468.

32433 (AD-777718) ANNUAL RESEARCH REPORT, 1 JULY 1972-30 JUNE 1973. (Armed Forces Radiobiology Research Inst., Bethesda, Md. (USA)). 30 Jun 1973. 127p. (AFRRI-ARR-7). NTIS $4.75.

The scientific accomplishments of the armed forces radiobiology research institute (AFRRI) for the period 1 July 1972 to 30 June 1973 are described. During this report period, the AFRRI has broadened its research program from one primarily limited to operational problems in radiation biology to one that includes a number of critical biomedical problems of direct interest to the Surgeons General of the military departments. The establishment of a neurobiology department and the expansion of nuclear medi-

cine activities are reflected in a significant number of technical summaries in this report. (GRA)

32434 (AEC-tr-7571, pp 73-79) PECULIARITIES OF THE FORMATION OF CHROMOSOME ABERRATIONS IN THE IRRADIATION OF CELLS IN THE RESTING STAGE AND DURING PREPARATION FOR DIVISION. Luchnik, N. V.; Sevan'kaev, A. V.; Kozlov, V. M. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 219-223(1974).

Human lymphocytes were irradiated with the γ rays of ^{60}Co at doses of 50, 100, and 200 rad at various times after stimulation with PHA and were fixed after 50 hrs or were irradiated 45 hrs after stimulation but fixed at various times. Both series of experiments gave similar results for most of the quantitative indices of the cytogenetic effect. But in series I, chromosome-type exchanges predominated over fragments, while in series II the opposite relationship was observed. These results agree with the hypothesis that the replication of a chromosome is preceded by conjugation and mutual proof of its subunits. (tr-auth)

32435 (AED-CONF-73-253-001) NNR CARCINOMA 4 YEARS AFTER A NEPHROBLASTOMA ON THE SAME SIDE: WAS THIS A RADIATION-INDUCED SECOND TUMOR? Gadner, H.; Riehm, H.; Weber, B. (Freie Univ. Berlin (F. R. Germany). Kinderklinik und Poliklinik). 1973. 2p. (In German). (CONF-730599-1).

From 22nd meeting of the Nordwestdeutsche Gesellschaft fuer Kinderheilkunde; Wolfsburg, F. R. Germany (11 May 1973).

In 1966 a nephroblastoma was observed on the right-hand side of a now ten-year-old girl. After nephrectomy, the renal bed was subjected to telecobalt irradiation with a focal dose of 3,000 rad. In addition, the girl received actinomycin D over a period of 30 months. Four and a half years later, a NNR carcinoma was identified on the same side. The authors are discussing the question as to whether the formation of the NNR carcinoma can be due to the combined radiation and chemical therapy and come to the conclusion that this cannot be ruled out altogether but that it seems highly improbable. (GE)

32436 (AED-CONF-73-546-004) CALCULATION OF RADIATION DOSE FROM AVAILABLE DATA. Leetz, H. K. (Universitaet des Saarlandes, Homburg/Saar (F. R. Germany). Inst. fuer Biophysik). 1973. 12p. (In German). (CONF-731150-2). INIS.

From 14th annual meeting of the Vereinigung Deutscher Strahlenschutzaerzte; Wuerzburg, F. R. Germany (16 Nov 1973).

4 figs.; 3 tabs.; 7 refs. Available from ZAED.

A method is discussed for determining or reliably assessing dose values for any part of the body on the basis of rather general data and data recorded in compliance with paragraph 24.2 of the X-Ray Ordinance. The example given illustrates the mathematical determination of the dose to the gonads. (GE)

32437 (BNWL-1850(Pt.4)) PACIFIC NORTHWEST LABORATORY ANNUAL REPORT FOR 1973 TO THE USAEC DIVISION OF BIOMEDICAL AND ENVIRONMENTAL RESEARCH. Part 4. Physical and Analytical Sciences. Nielsen, J. M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Feb 1974. Contract AT(45-1)-1830. 127p. Dep. NTIS $5.45.

Separate abstracts were prepared for each of the 4 sections of the report. Publications on the research made during the year are listed. (MCG)

For abstracts of individual sections see: 32203, 32438, 32568, and 34017.

32438 (BNWL-1850(Pt.4), pp 97-104) ARTIFICIAL HEART PROGRAM. Feb 1974.

In Pacific Northwest Laboratory annual report for 1973 to the USAEC Division of Biomedical and Environmental Research.

The radiation dose to patients from radioisotopic heat sources suitable for circulatory support systems was estimated. Radioisotopic heat source holders and shams for use in an animal study to assess the combined effects of heat and radiation from implanted plutonium heat sources were developed. Improved input data and an ancillary code developed for specification of source strength and spectra have been used in parametric computations of dose rates to organ systems and whole body. Conceptual designs of heat source holders for abdominal implantation of heat sources have been completed. Estimates were made of the radiation dose to the population that would result from successful development and routine use of ^{238}Pu fueled artificial hearts. Preliminary calculations indicated the most significant component of dose was that transmitted to spouses. Because the age and sex of persons exposed are critical factors in developing estimates of possible genetic or somatic effects, the objectives of the study were broadened to develop greater definition of the age and sex of persons potentially exposed. The relative economics and technical practicability of various approaches to producing both high-quality (low ^{236}Pu content) and high-purity (low dilution from other plutonium isotopes) ^{238}Pu for medical use by irradiating ^{241}Am recovered from spent power reactor fuel are compared and evaluated. (CH)

32439 (CONF-741018-3) SUMMARY: ISLANDWIDE RADIATION SURVEY IN PUERTO RICO, 1968-1973. Gileadi, M. (Puerto Rico Nuclear Center, Mayaguez). 1974. 12p. Dep. NTIS $4.00.

From 8th midyear topical symposium of the Health Physics Society; Knoxville, Tennessee, USA (21 Oct 1974).

Based upon data derived within the framework of the Joint Radiation Survey, Puerto Rico, 1968 to 1973, and the Joint Dental Survey, Puerto Rico, 1968 to 1973, certain potential health hazards associated with medical and dental x-ray diagnosis in Puerto Rico were evaluated. The primary concern of the Joint Radiation Survey was to evaluate the hazards due to unintentional gonadal irradiation associated with a carefully selected group of diagnostic x-ray procedures, and if possible, to help the medical community in reducing the hazards from radiation to a minimum compatible with the diagnostic objective. The annual rate of diagnostic x-ray examinations served as the frequency indicator enumerated by age-sex group, geographic location, type of medical facility, and type of examination. The corresponding dose value was used as an indicator of the magnitude. At the same time, technical parameters of the x-ray units involved were extensively investigated and relevant data properly tabulated. This led to an islandwide census of all x-ray units (medical, dental, and therapeutic) operative in Puerto Rico during 1968. Quantifiers used to describe the hazards, both in magnitude and in frequency of occurrence included: per capita per annum gonadal dose by age-sex group and by type of diagnostic procedure; mean gonadal dose per x-ray procedure by sex of patient; and genetically significant dose (GSD) by sex and by type of diagnostic procedure. A detailed statistical study of abdominal, chest, and dental x-ray procedures performed in Puerto Rico was made and relevant results are presented. The results included an extensive dosimetric study geared to determine the average gonadal dose associated with each diagnostic procedure considered. (auth)

32440 (CONF-741018-4) POPULATION EXPOSURE TO NATURAL RADIATION BACKGROUND IN PUERTO RICO. Gileadi, A. E.; Pitre, D. L. (Puerto Rico Nuclear Center, Mayaguez). 1974. 8p. Dep. NTIS $4.00.

From 8th midyear topical symposium of the Health Physics Society; Knoxville, Tennessee, USA (21 Oct 1974).

External exposure to natural radiation background of the population in Puerto Rico was estimated using published data concerning terrestrial and cosmic radiation, and demographic data on population distribution with respect to elevation and geographic location. (auth)

32441 (CONF-741018-5) AGE FACTORS FOR DOSE RATES FROM AN INFINITE CLOUD OF A PHOTON EMITTER. Poston, J. W.; Snyder, J. W.; Warner, G. G. (Oak Ridge National Lab., Tenn. (USA)). 1974. 9p. Dep. NTIS $4.00.

From 8th midyear topical symposium of the Health Physics Society; Knoxville, Tennessee, USA (21 Oct 1974).

Estimates of the radiation dose to many of the various organs of the body have been given for an adult immersed in an infinite cloud of a photon emitter (Health Phys., 26: 287(1974)). Similar results are now available for phantoms representing individuals of ages 0 (newborn), 1, 5, 10, and 15 years of age. The ratio of the dose rates received per microcurie-hour of exposure of the younger individuals to that for the adult is examined. The results can be expressed as a set of curves, one for each target organ, and for the different ages. In general, the ratios are higher for the younger individuals and for the newborn are frequently higher by a factor of 10 or more. There are a number of departures from this simple generalization which can be interpreted in terms of depth of the organ below the surface of the body, photon energy, etc. These curves are convenient for calculation of the doses received by various segments of the population or for estimation of the average dose received by a population from an infinite cloud source. Examples are given for ^{85}Kr and ^{133}Xe. (auth)

32442 (COO-3017-17) EFFECTS OF OCCUPATIONAL AND ENVIRONMENTAL EXPOSURES TO IONIZING RADIATION. Warren, S. (New England Deaconess Hospital, Boston, Mass. (USA). Cancer Research Inst.). 1974. Contract AT(11-1)-3017. 26p. Dep. NTIS $4.50.

Data are presented on the sources and kinds of radiation to which man is exposed and the contribution of natural radioactivity, medical and dental diagnostic tests, occupational exposure, and nuclear power development to the average radiation dose rate to the gonads,

bone-forming cells, bone marrow cells, and whole-body of the average individual. These data show that natural radioactivity contributes 102 millirads/yr to the whole-body dose, medical and dental examinations contribute 73 millirads/yr, occupational exposure contributes 0.8 millirads, and nuclear power contributes 0.003 millirads/yr. The mechanisms involved in the induction of radiation injuries to cells are reviewed and data are summarized from studies on the pathological effects of various doses of acute and chronic external and internal irradiation on laboratory mammals and available data on man are presented. The role of the US National Council on Radiation Protection and the International Committee on Radiological Protection in the development of radiation protection standards is discussed. It is pointed out that there is no evidence of deleterious effects within the present permissible dose levels. (32 references) (CH)

32443 (GSF-S-232) DATA OF DOSE VALUES IN THE FRACTIONATED RADIOTHERAPY. Wachsmann, F. (Gesellschaft fuer Strahlen- und Umweltforschung m. b. H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). 1972. 9p. (In German).

From Autumn meeting of the Bayerische Roentgengesellschaft; Kaufbeuren, F. R. Germany (Oct 1972).

The stating of the total dose adminstered is not sufficient to give a clear picture of the biological effects to be expected following therapeutical irradiations. As the amount of the individual doses and the length of pauses between irradiation, i.e. the type of fractionating as well as possibly the protracted treatment considerably influence the effect of a given dose; these are always to be given. The nominal single dose (NSD) from Ellis and his school is very useful in this connection, exacter data, the determination and application of which are given. (GE)

32444 (NP-20162) ANNUAL REPORT 1973. (Statens Institutt for Strasalehygiene, Oslo (Norway)). 1974. 20p. (In Norwegian). Dep. NTIS (US Sales Only) $4.00.

Radiation surveillance work included 132 calibrations of radiotherapy facilities and medical radiography installations at 141 clinics, 67 mobile radiography units, 36 mass radiography units, 156 dental radiography units, 5 chiropractitioner radiography units, 22 isotope laboratories and various industrial radiometric and radiography units. Personnel dosimetry statistics are also given. An investigation of the contribution of diagnostic radiography to the radiation dose to the skin and gonadal doses are listed, and the population mean bone marrow dose was calculated to be 11.2 mrad/person year and the genetically significant dose was calculated to be 0.045 mrad/person year. Conclusions as to equipment specifications and irradiation procedures are given. Results of measurements of fallout ^{137}Cs in the Lapp population and in fresh reindeer meat are given. Measurement of the ^{90}Sr content of reindeer meat and bone and lichen were also made. Measurements of total β activity in air, drinking water, and precipitation in the Oslo area has continued. Information work and training courses also form an important activity. (NO)

32445 (PB-230090) PROTECTING AND IMPROVING HEALTH THROUGH THE RADIOLOGICAL SCIENCES. (Public Health Service, Washington, D. C. (USA)). Apr 1966. 32p. NTIS $4.75.

The report is the third in a series prepared by the National Advisory Committee on Radiation for the Surgeon General of the Public Health Service. The committee traces the remarkable growth that has taken place in the uses of ionizing radiation in the health professions, in industry, and in other walks of life. It also notes a number of emerging problems that not only are of importance from the point of view of radiation protection, but also, if not alleviated, threaten the quality of medical care in the United States and the advances of atomic research into needed benefits for the people. (GRA)

32446 (RISO-M-1725) MODELS FOR CALCULATION OF EXTERNAL GAMMA DOSES AND INHALATION DOSES FROM RELEASES OF RADIOACTIVE ISOTOPES TO THE ATMOSPHERE. Thykier-Nielsen, S. (Danish Atomic Energy Commission, Risoe. Research Establishment). Jul 1974. 48p. (In Danish). Dep. NTIS (US Sales Only) $5.50.

A model was developed which permits calculation of the downwind radiation doses from a release of radioactive isotopes. The model can be used for calculating external γ doses, as well as internal doses due to inhalation of radioactive material. The Gaussian plume model is used assuming release from a point source with either constant leak rate or leak of a constant fraction of a given amount per time unit. Fall-out and wash-out are accounted for, as are the changes in concentration due to variation of the wind-direction during the release. Furthermore radioactive decay is accounted for as well as growth and decay of daughter products. Based on the model two computer programs were written for the calculation of doses to individuals: GDOS (external gamma doses) and INDOS2 (inhalation doses). Both programs assume constant leak-rate and GDOS does not take into consideration fall-out, wash-out, and variation of the wind-direction. (auth)

32447 (WASH-1332(74)(Vol.1), pp 445-475) WORKSHOP ON THE ASSESSMENT OF POPULATION DOSE AND HEALTH RISK, TUESDAY EVENING, APRIL 16, 1974. Welty, C.; Cooper, R. (Atomic Energy Commission, Washington, DC). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

Methods used in calculating the radiation dose received by the general population residing in the environs of AEC operations are reviewed. The relationship of these dose estimates in determining the health hazards of low-dose internal or external radiation exposure is discussed. (CH)

32448 EXTENDED MANTLE RADIOTHERAPY IN HODGKIN'S DISEASE AND MALIGNANT LYMPHOMA. Marks, J. E.; Moran, E. M.; Griem, M. L.; Ultmann, J. E. (Univ. of Chicago). Amer. J. Roentgenol., Radium Ther. Nucl. Med.; 121: No. 4, 772-788 (Aug 1974).

From 55th annual meeting of the American Radium Society; Colorado Springs, CO (22 Apr 1973).

The extended mantle field for radiotherapy of Hodgkin's disease and malignant lymphoma eliminates the necessity for splicing at the level of the diaphragm and thereby eliminates the potential for radiation-induced transverse myelitis. Experience with 95 patients is described. Modifications in technique, including changes in the geometry of the field, shielding, time, dose, fractionation, and simulation are described. End results, an analysis of failures, and complications encountered are presented. Morbidity was acceptable despite the increase in integral dose, particularly in young patients who were not debilitated by disease. The danger of radiation-induced esophagitis, dehydration, hemoconcentration, and pulmonary embolism is stressed. (auth)

32449 RESULTS OF SPLIT-COURSE RADIATION THERAPY IN CANCER OF THE LUNG. Scruggs, H.; El-Mahdi, A.; Marks, R. D. Jr.; Constable, W. C. (Univ. of Virginia, Charlottesville). Amer. J. Roentgenol., Radium Ther. Nucl. Med.; 121: No. 4, 754-760(Aug 1974).

Split-course radiotherapy of carcinoma of the lungs has apparently improved survival with no loss in palliation or increased morbidity except for the question of radiation myelitis. It is anticipated that modifications in treatment planning can eliminate the latter complication. Success would seem to be related to the utilization of large initial fractions as well as the rest period and a controlled clinical trial is urgently needed. To that end, a randomized study employing these concepts has been launched as a national cooperative study. (CH)

32450 INFLUENCE OF FRACTIONATION ON ACUTE AND LATE REACTIONS IN VOCAL CORD CARCINOMA. Loeffler, R. K. (Radiation Center, Massilon, OH). Amer. J. Roentgenol., Radium Ther. Nucl. Med.; 121: No. 4, 748-753(Aug 1974).

From 55th annual meeting of the American Radium Society; Colorado Springs, CO (22 Apr 1973).

Four schedules for the ^{60}Co γ treatment of localized vocal cord carcinoma were compared, to establish a relationship between daily and total dose, and acute and late normal tissue reactions. All patients were treated 5 days per week. All of those who received 200 R daily (6,000 R in 30 treatments) developed a confluent mucositis and minimal to moderate subsequent aryepiglottic edema. Patients who received 180 R daily (6,480 R in 36 treatments) developed a patchy mucositis. Those who received 170 R daily (7,140 R or 6,400 rads in 42 treatments) developed only a brisk erythema, with decreasing incidence and severity of edema. At 160 R daily (6,880 R in 43 treatments) only a mild erythema developed, with no visible edema at any time. Local recurrence rates of about 10% for T_1 lesions, and of about 25% for T_2 and T_3 lesions, indicate that the decrease in reactions with longer fractionation has been achieved without loss of tumor control. Even minimal improvement in functional status following treatment for this highly curable malignancy well justifies the inconvenience of the increased number of treatments. The present formula of Ellis for normal tissue tolerance is not consistent with these findings, since the NSDs are essentially identical for all 4 schedules, while tolerance is notably improved by increasing fractionation. (auth)

32451 CLINICAL MANIFESTATIONS OF GRAFT-VERSUS-HOST DISEASE IN HUMAN RECIPIENTS OF MARROW FROM HL-A-MATCHED SIBLING DONORS. Glucksberg, H.; Storb, R.; Fefer, A.; Buckner, C. D.; Neiman, P. E.; Clift, R. A.; Lerner, K. G.; Thomas, E. D. (Univ. of Washington, Seattle). Transplantation; 18: No. 4, 295-304(Oct 1974).

Sixty-one evaluable patients, 19 with advanced aplastic anemia

and 42 with end stage hematological malignancies, were conditioned for marrow grafting with total-body irradiation or cyclophosphamide, or a combination of both. Marrow graft donors were siblings matched at the HL-A region and nonreactive in mixed leukocyte culture. All patients received methotrexate postgrafting to modify anticipated graft-versus-host disease (GVHD). Forty-three of the 61 patients developed clinically recognizable GVHD. In seven GVHD was limited to the skin. In the remaining patients, skin involvement was more severe and was followed by gastrointestinal involvement manifested by anorexia, nausea, diarrhea, abdominal pain, and malabsorption and/or liver involvement manifested by hepatomegaly, rises in serum glutamic oxaloacetic acid transaminase, and bilirubin. The severity of GVHD showed no correlation with the underlying disease, the conditioning regimen, or the day of onset after grafting. Fourteen of 25 patients without GVHD or with only skin involvement are alive. By contrast, only 5 of 36 with severe GVHD are alive. Twenty-six of the 36 patients with severe GVHD succumbed to infection, whereas only 4 of 25 without GVHD or with only skin involvement did so. The results show that despite histocompatibility matching and methotrexate therapy, GVHD remains a serious and often fatal complication of marrow transplantation. (auth)

32452 RADIOTHERAPY ISODOSE CURVES BY A SUPERPOSITION METHOD. Denisenko, O. N.; Kozlov, V. A.; Chilingarov, K. M.; Zhuravleva, L. M. (Scientific-Research Inst. of Medical Radiology, Moscow). Med. Radiol.; 19: No. 10, 60-67 (Oct 1974). (In Russian).

The problem of forming dose rulers is considered with the help of a superposition method. This method makes it possible to single out a basic number of sources, simplifies the carrying out of dosimetric work and finding of analytical expressions for description of some amount of dose fields used in radiation therapy. It was shown, in particular, that superposition of roentgen and gamma radiations was equivalent to the source with adjustable effective energy of radiation quantum. (auth)

32453 POPULATION DOSE FROM MEDICAL RADIATIONS AND SOME RELATED PROBLEMS. Hashizume, T. (National Inst. of Radiological Sciences, Chiba, Japan). Nippon Genshiryoku Gakkaishi; 15: No. 12, 809-821(Dec 1973). (In Japanese).

Some problems relating to the population dose from medical radiations and the future of medical exposure were considered. Problems in experimental measurement of radiation doses are discussed. Surveys on genetically significant doses from diagnosis, bone marrow significant doses from treatment, other population doses from medical radiation, and exposure doses to medical personnel are considered. Population doses obtained during the second survey beginning in 1968 were compared with those obtained in the earlier survey of 1957. Genetically significant doses and significant doses causing leukemia were explained. From these two surveys, the problems of the population doses were explained from the point of view of the medical physicians, the x-ray technicians, and the physicists. (JA)

32454 GAMMA DOSE CALCULATOR. Khrushchov, M. M.; Dostanova, T. K.; Gurevich, N. I. Med. Radiol.; 19: No. 10, 38-42(Oct 1974). (In Russian).

A calculator intended for calculation of fractionation parameter under the conditions of telegamma-therapy is described. The Ellis formula is used as its mathematical basis. A special scale which reflects the correlative connection between the tolerant dose and the field size is placed in the machine for calculations of the standardized dose. The calculator is also equipped with calendar scales to calculate the time of the course of treatment depending upon the day of the week on which the course of radiation therapy began. (auth)

32455 SIMPLIFIED METHOD OF DETERMINING EQUIVALENT DOSES FOR DIFFERENT REGIMENS OF FRACTIONATION IN THE TREATMENT OF MALIGNANT TUMORS. Kholin, V. V.; Frolova, Z. V.; Bartova, V. F. (Leningrad Inst. of Advanced Medicine). Med. Radiol.; 19: No. 10, 42-46(Oct 1974). (In Russian).

Graphs for establishing equivalent (in biological respect) doses are shown for all cases of a dose increase beyond the fraction in daily and not daily fractionated irradiation of tumors. This not only simplifies the work of a physician when establishing equivalent doses but also makes it possible to change over from empirical planning of irradiation to a different form of prognosing the expected reaction. (auth)

32456 CLINICO-DOSIMETRIC CORRELATION IN LOCAL IRRADIATION FROM SOURCES OF DIFFERENT ENERGY. Barabanova, A. V.; Sokolina, L. L.; Novikova, L. V. (Inst. of Industrial Hygiene and Preventive Medicine, Moscow). Med. Radiol.; 19: No. 10, 46-51(Oct 1974). (In Russian).

Results are presented of observation made over 30 patients with occupational local radiation affections from sources of different energies widely employed in national economy (gamma sources ^{60}Co, ^{137}Cs, and ^{134}Cs, x-ray apparatuses for roentgenostructural analysis and a beam of linear accelerators of electrons). Irradiation doses were determined retrospectively where it was possible by means of modelling irradiation conditions on the phantom and also by the calculation method taking into account the timing of manipulations at the moment of irradiation. The comparison of clinical manifestations with the value of dose loads shows that the knowledge of absorbed energy distribution by the depth is of great importance for making the prognosis of the course of the disease and the choice of the method of treatment. (auth)

32457 INTERACTION DISTANCE OF PRIMARY LESIONS IN THE FORMATION OF DICENTRIC CHROMOSOMES AFTER IRRADIATION OF HUMAN LYMPHOCYTES WITH 3-MeV ELECTRONS IN VITRO. Bauchinger, M.; Schmid, E.; Rimpl, G. (Univ., Munich). Mutat. Res.; 25: No. 1, 83-87(Oct 1974).

The rejoining distance for the formation of dicentric chromosomes in human lymphocytes is derived on the basis of microdosimetric concepts. For the formation of a dicentric chromosome, primary lesions produced by absorption events can interact within the nucleus over a distance of between 0.5 and 1.0 μ. The intercellular distribution of dicentric chromosomes is consistent with a Poisson distribution. (auth)

32458 ACCIDENTAL IRRADIATION OF SKIN ON HANDS WITH A PROTON BEAM OF 4 MeV ENERGY. Dziuk, E.; Merta, A.; Bocian, E. (Wojskowa Akademia Medyczna, Warsaw (Poland). Instytut Ksztalcenia Podyplomowego; Institute of Nuclear Research, Warsaw (Poland). Dept. of Radioprotection; Institute of Nuclear Research, Warsaw (Poland). Dept. of Radiobiology and Health Protection). Strahlentherapie; 146: No. 6, 685-692 (Dec 1973).

6 figs.; 14 refs.

A case of skin irradiation on the hands of a young woman with a 4-MeV proton beam is described. The mean dose absorbed by the skin was estimated at 2 Mrd. On the irradiated areas of the fingers, oedemas and erythema appeared and, after subsidence of the inflammatory state, also foci of skin thickening and decoloration. As treatment, steroids were locally applied (Synalar ointment). After two months the changes in the skin disappeared and the papillar pattern of finger skin was undamaged. The chromosomes of blood lymphocytes were investigated and plethysmography was performed. The 20-month observation did not reveal any pathological symptoms. (auth)

32459 THE HYPERNEPHROID CARCINOMA. Methods and Results of Postoperative Radiotherapy in 223 Patients. Voss, A. C.; Woeilgens, P.; Kloeckner, D. (Katharinenhospital, Stuttgart (F. R. Germany). Strahlenklinik). Strahlentherapie; 147: No. 5, 447-458(May 1974). (In German).

1 figs.; 2 tabs.; 17 refs.

Optimal therapeutic methods for the hypernephroid carcinoma, which amounts to 75 to 85% of all renal malignancies, consists in operation with postoperative radiotherapy. Since 1969, the postoperative irradiation performed in our clinic is a routine combination of ventral telecobalt pendulum irradiation with a stationary dorsal electron field. 223 patients with histologically ascertained hypernephroid carcinoma were followed up in regular intervals during 3 to 5 years. Without consideration of the various types of tumours, the 3-years survival rate amounts to 50%, the 5 years survival rate is 47%. Classification and evaluation of the results was made according to the TPNM-classification, internationally introduced in 1972. (auth)

32460 HISTOLOGICAL EXAMINATION OF THE BONE MARROW (ILIAC CREST) FOLLOWING LOCAL GAMMA IRRADIATION IN 11 PATIENTS WITH GENITAL CARCINOMA. Beil, E.; Penning, W.; Burkhardt, R. (Gesellschaft fuer Strahlen- und Umweltforschung m. b. H., Muenchen (F. R. Germany). Inst. fuer Haematologie; Muenchen Univ. (F. R. Germany). 2. Frauenklinik). Klin. Monatsbl. Augenheilk.; 52: No. 7, 326-333(Apr 1974). (In German).

6 figs.; 5 tabs.; 12 refs.

Histological examination of the bone marrow (iliac crest) in 11 patients with genital carcinoma was carried out. Bone marrow was obtained 3 times by myelotomy, before irradiation and shortly after approximately 1,100 R and 3,000 R, respectively (local fractionated gamma irradiation). Two different histologic types of the acute and subacute irradiation damage are noted: The one is characterized by formation of edema and plasma cell infiltration, the other one by lymphoid cell infiltration and sclerosis. Common features of both types are necrosis of the arterial capillaries and venous sinusoids with only minor changes

of the arteries and increased osteoblastic and osteoclastic activity of the bone and siderosis. (auth)

32461 IMPROVEMENT OF THE DOSE DISTRIBUTION FOR CONFORMATION IRRADIATION OF CERVIX CARCINOMAS. Morita, K.; Kimura, C.; Takahashi, K.; Ueda, T. (Aichi Cancer Center, Nagoya (Japan). Dept. of Radiation Therapy). Strahlentherapie; 147: No. 5, 487-497(May 1974). (In German).

12 figs.; 12 refs.

In 1970 the first therapeutic results of conformation irradiation in carcinoma of the cervix were reported. The dose distrition for technical reasons was unsatisfactory. By improvement of the conformation apparatus and additional application of biaxial pendulum technique a homogenous dose distribution was obtained in the irradiation of cervix carcinomas. The application principles of this method are described. (GE)

32462 RADIATION DOSIMETRY AND INTRAORAL RADIOGRAPHIC TECHNIQUES. II. Internal and External Dose Measurements. Frey, N. W. (Univ. of California, Los Angeles); Wuehrmann, A. H. Oral Surg., Oral Med., Oral Pathol.; 38: No. 4, 639-652(Oct 1974).

Absorbed doses of x radiation delivered to a Rando phantom head by seven intraoral radiographic techniques were measured during production of acceptable single molar bitewing radiographs. Techniques included three kilovoltages (50, 65, and 90 KVP), three source-to-skin distances (4.5, 8.5, and 16.5 inches), and two types of position-indicating devices (lead-lined cylinders and pointed plastic cones). One hundred fourteen thermoluminescent dosimeters were placed in the head and positioned to measure intrabeam and extrabeam doses. Skin entrance doses were higher for low KVP and plastic cone techniques. Doses recorded at skin exit surfaces were low and indicated that little radiation escaped from the phantom during exposure. Single bitewing film surface doses which produced comparable film densities ranged from 70.35 mrads to 79.95 mrads for all except the 50 KVP technique, which required a dose of 95.75 mrads. The 65 KVP, 16.5 inch source-to-skin distance, and open-end, lead-lined cylinder technique gave the lowest total measured dose of all techniques, followed by the 90 KVP, 16.5 inch source-to-skin distance, and open-end, lead-lined cylinder technique. Techniques utilizing pointed plastic cones delivered the greatest total doses, with the 50 KVP, 4.5 inch source-to-skin distance, and pointed cone technique ranking poorest. (auth)

32463 ESTABLISHMENT OF TREATMENT PLANES IN INTRACAVITARY MANAGEMENT OF VAGINAL NEOPLASIA WITH ^{192}Ir WIRES. Volterrani, F.; Donati, G.; Rabbi, A. (Univ., Milan). Radiol. Med.; 60: No. 4, 320-334(Apr 1974). (In Italian).

A calculation program was used to determine the arrangement and dosimetry of ^{192}Ir wires employed in the intracavitary management of vaginal neoplasia under various clinical conditions. Some typical instances of its application are described. (auth)

32464 EMPLOYMENT OF A SIMULATOR IN LOCALIZATION AND CENTERING FOR RADIOTHERAPY. Peracchia, G. (Univ., Parma, Italy). Radiol. Med.; 60: No. 4, 309-319(Apr 1974). (In Italian).

The "Simulix", a simulator manufactured by Oude Delft, is described and its performance and operation are explained. Its features are examined in the light of present views concerning simulation in radiotherapy. (auth)

32465 EXPERIMENTAL AND THEORETICAL BASIS OF USING ^{252}Cf IN CONTACT NEUTRON THERAPY. Letov, V. N.; Ryabukhin, Yu. Ya.; Elisyutin, G. P.; Sul'kin, A. G. (Scientific Research Inst. of Medical Radiology, Moscow). Med. Radiol.; 19: No. 9, 58-68(1974). (In Russian).

The production of ^{252}Cf with a high neutron yield per unit weight makes it possible to prepare miniature sources for contact neutron therapy. The dosimetry of ^{252}Cf sources in therapeutic applications showed that the dose field around the source is caused primarily by geometric factors; the absorbed dose was decreased with distance somewhat faster than for ^{226}Ra sources. The ratio of the absorbed dose caused by neutron and γ components was altered from 1.5:1 at a distance of 0.5 cm to 1:1 at distances of 4 cm from the source. The spectrum of linear energy loss at distances from 0.5 to 5 cm from ^{252}Cf sources was practically unchanged. The relatively short half-life of ^{252}Cf requires constant corrections in the dosimetry for clinical uses of ^{252}Cf sources. It was established from radiobiological studies that the value of the relative biological effectiveness of the mixed radiation of ^{252}Cf on the cellular system of normal tissues and tumurous tissues at therapeutic dose outputs deviates from 2.3 to 4.8. The relative biological effectiveness of ^{252}Cf for the skin of swine is 5 to 7 and the relative oxygen effect, produced on cell cultures at dose outputs usually used in contact therapy, is 1.4 to 1.8. The recovery coefficient is 1.5 to 1.6. The maximum permissible dose in contact neutron therapy with the mixed radiation of ^{252}Cf is 1140 rad which leads to the appearance of epidermal lesions covering no more than 50% of the irradiated skin surface. In vivo experiments on the relative biological effectiveness and the relative oxygen effect on tumors were not made. (tr-auth)

32466 INTERSTITIAL RADIOTHERAPY FOR INTRAORAL CARCINOMA. Ochsner, S. F.; Collins, V. P. (Ochsner Medical Center, New Orleans). S. Med. J.; 67: No. 10, 1150-1154 (Oct 1974).

From International Congress of Radiology; Madrid, Spain (18 Oct 1973).

Carcinoma in the intraoral area presents many problems in management and eradication. Interstitial radiation is a useful method of treating this condition for several reasons: the radiation dose in the tumor is maximal and high in the surrounding tissues, but in the normal tissues a few centimeters away it is low; the physical discomfort of the patient is lessened; and, hospitalization may be shortened or eliminated. Radon seed implantation is a convenient and effective method of interstitial irradiation. In many patients, the radon seed implant may be supplemented by external beam therapy. Examples are presented to illustrate the advantages of interstitial radon seed therapy in carcinoma of the floor of the mouth, anterior portion of the tongue, palate, tonsil, and oropharynx. (auth)

32467 EMERGENCY MEDICAL MANAGEMENT OF RADIATION ACCIDENTS. Suzuki, M. (National Inst. of Radiological Sciences, Chiba, Japan). Nippon Genshiryoku Gakkaishi; 16: No. 2, 65-73(Feb 1974). (In Japanese).

Emergency measures in atomic power facilities were described. Exposure doses were calculated from the distance between the irradiated person and the radiation source and from chromosomal aberrations observed in lymphocyte cultures. The significance of hematological changes for determining therapy of accident victims was emphasized. The importance of communication between management personnel was mentioned. Problems concerning the relationship between atomic power facilities and regional hospitals were discussed. Emergency medical systems in Europe and the United States were described. (HLW)

32468 RADIATION-INDUCED PULMONARY LESIONS FOLLOWING IRRADIATION OF SCAR AFTER SURGICAL TREATMENT FOR MAMMARY CARCINOMA. Wojcieszek, Z.; Szelc, S. (Inst. of Oncology, Gliwice, Poland). Pol. Przegl. Radiol. Med. Nukl.; 38: No. 3, 283-287(1974). (In Polish).

In the years 1947 to 1959 patients after radical mastectomy for carcinoma were treated with radiotherapy under conventional conditions irradiating large areas (400 sq. cm). In all, 353 cases were treated in this way. In 48.5% of cases radiological changes in the lungs were observed subsequently and in 11.6% of cases mediastinal shifting developed. (auth)

32469 INFLUENCE OF RADIOPROTECTIVE SUBSTANCES ON THE LEVEL OF GLYCOLYTIC COMPONENTS IN BLOOD PLASMA AND LIVER. Veninga, T.; Lemstra, W. (Rijksuniversiteit, Groningen, Netherlands). Acta Radiol., Suppl.; No. 310, 238-244(1971).

Mice treated with a hypoxic gas mixture exhibited an increased blood plasma level of phosphoglycerate kinase, pyruvate kinase, ATP, and total proteins. The liver content of the two first mentioned enzymes and ATP was not significantly altered after hypoxia, but hexokinase and fructose-6-phosphate kinase were decreased. Serotonin acted similar to hypoxia regarding the ATP level of liver and plasma, whereas AET had no influence upon ATP. In contrast, MEA caused a diminution of the plasma and liver ATP level. The observed modifications could be prevented by rendering the mice alloxandiabetic. The significance of the results is discussed. Whether they are correlated to radioprotection has to be established. (auth)

32470 WAVELENGTHS IN SUNLIGHT EFFECTIVE IN PRODUCING SKIN CANCER: A THEORETICAL ANALYSIS. Setlow, R. B. (Univ. of Tennessee, Oak Ridge). Proc. Nat. Acad. Sci. U. S. A.; 71: No. 9, 3363-3366(Sep 1974).

DNA is taken as the target for skin cancer induced by ultraviolet light, and the known data on the sensitivity of DNA as a function of wavelength are summarized. The sun's spectrum at the surface of the earth and the DNA action spectrum are used to calculate the carcinogenic effectiveness as a function of wavelength. The most effective wavelengths at 30°N latitude are <305 nm, and a 1% change in atmospheric ozone results in a 2% change in the effective dose of ultraviolet light. Since both the basic biological and physical data are reasonably precise, the major requirement for a quantitative evaluation of the dose response

relation for ultraviolet-induced skin cancer in man is better epidemiological data to compare with data from animal models. (auth)

32471 SCINTIGRAPHIC EVALUATION OF LIVER AND SPLEEN INJURY. Gilday, D. L. (Univ. of Toronto); Alderson, P. O. Semin. Nucl. Med.; 4: No. 4, 357-370(Oct 1974).

The liver and spleen may be damaged by blunt or penetrating trauma to the upper abdomen. Scintigraphic studies have proved quite useful in detecting the presence and delineating the extent of these injuries. In addition to the conventional anterior, lateral, and posterior views, special angulated and oblique views are sometimes needed. These studies provide the information that often is needed when surgical exploration is contemplated. Contrast angiography is used in equivocal situations. Iatrogenic changes caused by radiation or surgery of the liver may also be demonstrated and followed with scintigraphic studies. Examples of all these situations are included in this review. (auth)

32472 RAPID-COURSE RADIATION THERAPY OF CEREBRAL METASTASES: RESULTS AND COMPLICATIONS. Young, D. F.; Posner, J. B.; Chu, F.; Nisce, L. (Cornell Univ., New York). Cancer; 34: No. 4, 1069-1076(Oct 1974).

Eighty-three patients (Group A) with parenchymal brain metastases were treated with rapid-course whole brain irradiation (1500 rad in 2 treatments) and the results were compared retrospectively with a group of 79 patients (Group B) treated conventionally (approximately 3000 rad in 15 treatments). Neurologic improvement occurred in 57% of patients in Group A and 62.3% of Group B. Median duration of remission was shorter in Group A: 2.0 vs. 3.5 months ($p = 0.059$); median duration of survival was significantly shorter in Group A: 59 vs. 116 days ($p < 0.02$) (means: 103 vs. 147 days). Complications were significantly more frequent in Group A: 49.4% vs. 15.2% ($p < 0.01$). These included acute cerebral herniation (6 cases in Group A, 3 cases in Group B), headache, nausea and vomiting, and fever. The major advantage of the rapid course is the reduction of the period of treatment. Since lethal complications occurred primarily in patients with evidence for markedly elevated intracranial pressure, the rapid course should probably be withheld in such patients. (auth)

32473 RADIOBIOLOGICAL SUPPORT FOR RADIOTHERAPY. What Kind of Research? Alper, T. (Hammersmith Hospital, London). Lancet; 1: No. 7870, 1328-1330(29 Jun 1974).

The problems associated with the selection of the most effective radiotherapeutic regimen (conventional radiotherapy, hyperbaric oxygen radiotherapy or neutron therapy) for the treatment of a given tumor are assessed. The response of a pair of rat tumor lines (spindle-cell fibrosarcomas), of common origin and similar histology to increasing doses of x-radiation and neutrons in vitro was compared. The delay in growth, from the size at irradiation to some arbitary standard was related to the dose received. One line showed evidence of the presence of hypoxic cells, but higher values of the relative biological effectiveness of neutron irradiation were observed for the other line. The results emphasize the need for further quantitative data on the basic mechanisms of radiation action on human tumor and normal tissues in vivo and in vitro. (UK)

32474 PQR: A POSSIBLE WAY OF THINKING. Hedgran, A. A.; Lindell, B. B. (Statens Vattenfallsverk, Aelvkarleby, Sweden). Acta Radiol., Suppl.; No. 310, 163-172(1971).

Radiation protection is partly aimed at preventing accidents and partly aimed at keeping doses as low as practicable (in accordance with paragraph 52 of ICRP Publication No. 9). In the latter case, the law of diminishing return would imply that there is a practical optimum, below which it is not reasonable to go, considering the cost per unit dose reduction. The authors have tried to assess the effort that society is usually willing to spend for the elimination of one manrad. They have found that the current cost is about 500 dollars per manrad but suggest 200 dollars per manrad as a more reasonable value. Using this sum they suggest that any radiation exposure can be evaluated by calculating the cost which would be reasonable for the elimination of the corresponding radiation dose. This cost is denoted the PQR cost and any protective measure which eliminates a certain number of manrad may be attributed a PQR value by a similar evaluation. It is also shown that the PQR cost is not entirely void of any relations to other value standards, such as the efforts which are usually spent in situations where human lives are at stake at the same degree of risk but from other sources than radiation. Such comparisons, however, indicate that radiation protection is achieved at a high ambition level, implying a high value attached to human lives. (auth)

32475 RELATIVE IMPORTANCE OF HYPOXIC CELLS FOR THE RADIOTHERAPY OF HUMAN TUMORS. Kaplan, H. S. (Stanford Univ., CA). Eur. J. Cancer; 10: No. 5, 275-280(May 1974).

From second meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

Various aspects are discussed of the problem whether the presence of hypoxic cells in human tumors adversely influences radiotherapeutic cure rates to a clinically significant extent. Subsequently, the relative advantages and disadvantages of various approaches to deal with hypoxic cells in human tumors are analyzed, not only with respect to their usefulness in curing patients but also with respect to possible evidence in support of the importance of hypoxic tumor cells in radiotherapy. Finally, potential advantages of pion beams and heavy ion beams over fast neutron beams and high energy photons are pointed out with respect to their dose distributions in patients. (auth)

Vertebrates

Refer also to abstracts 32385, 32390, 32400, 32571, 32594, 32595, and 34540.

32476 (AD-777383) ACTIVITY CHANGES OF BRAIN ENZYMES IN RATS EXPOSED TO DIFFERENT QUALITIES OF IONIZING RADIATION. Catravas, G. N.; McHale, C. G. (Armed Forces Radiobiology Research Inst., Bethesda, Md. (USA)). Nov 1973. 17p. (AFFRI-SR-73-19). NTIS $3.00.

The effect of different qualities of ionizing radiation on the activity of brain enzymes involved in the metabolism of neurotransmitters in specific regions of the brain of rats was investigated. Groups of Sprague-Dawley adult male rats were exposed to approximately 20,000 rads of radiation either rich in neutrons or rich in gamma rays from the AFRRI-Triga reactor, in the form of a square wave approximately 90 seconds long. It was found that, when the animals were exposed to radiation rich in neutrons, monoamine oxidase activity was pronouncedly decreased in all brain areas studied. In contrast, a very marked increase in the activity of this enzyme was observed when the animals received the same dose of radiation rich in gamma rays. Minor changes were observed in the activities of choline acetyl transferase and RNA polymerase. Acetylcholinesterase activity did not change appreciably. (auth)

32477 (AEC-tr-7571) RADIOBIOLOGY, VOL. 14, NO. 2, 1974. Translation of Radiobiologiya; 14: No. 2, 163-320(1974). 214p. Dep. NTIS $7.60.

Separate abstracts were prepared for 35 of the 36 papers in this issue. The other paper discusses the progress of the Academy of Sciences USSR on the occasion of its 250th birthday. (ERB)

For abstracts of individual papers see: 32358, 32359, 32375, 32395–32397, 32417, 32434, 32478–32501, 32558, 32566, and 32567.

32478 (AEC-tr-7571, pp 7-11) INFLUENCE OF EXOGENOUS DNA ON THE INTENSITY OF DNA SYNTHESIS IN RADIOACTIVE TISSUES OF IRRADIATED RATS. Golyshev, E. P.; Rubachev, P. G.; Uspenskaya, M. S. (Inst. of Biophysics, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 168-171(1974).

The intensity of DNA synthesis in radiosensitive tissues of rats was studied after irradiation at a dose of 600 R and administration of preparations of high-polymer DNA, considering the dilution of the labeled precursor in the organism by the unlabeled analog. Exogenous DNA, introduced 1 or 24 hrs after irradiation, stimulates the rate of incorporation of ^{14}C-thymidine into the DNA of the spleen, thymus gland, and bone marrow of rats. An increase in the endogenous pool of thymidine, occurring as a result of degradation of exogenous DNA, may mask this effect to a substantial degree. (tr-auth)

32479 (AEC-tr-7571, pp 12-17) EXOGENOUS DNA AND ACTIVITY OF ASPARTATE CARBAMOYL-TRANSFERASE, DNA POLYMERASE, AND DNAases IN THE HEMOPOIETIC ORGANS OF IRRADIATED RATS. Moskaleva, E. Yu.; Mazurik, V. K. (Inst. of Biophysics, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 172-176(1974).

Exogenous DNA eliminated certain disturbances of nucleic acid metabolism in the hemopoietic organs of irradiated rats: it increased the rate of restoration of the DNA polymerase activity in the bone marrow on the fifth to eighth day after irradiation at a dose of 600 R and normalized the activity of key enzymes of nucleic acid biosynthesis, aspartate carbamolytransferase and DNA polymerase, on the 14th to 20th days after the radiation influence. The changes in the activity of DNAases were analogous. The most substantial influence of DNA on the enzyme activity was observed in the bone marrow. (tr-auth)

32480 (AEC-tr-7571, pp 18-23) INFLUENCE OF IRRADIATION ON THE DNA POLYMERASE ACTIVITY OF THE BONE MARROW. Elkina, N. I. (Inst. of Biophysics, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 177-180(1974).

The DNA polymerase activity in the rat bone marrow was studied for a period of six days after a single γ irradiation at a dose of 820 R ($LD_{95/30}$). During the first two hrs after irradiation, the incorporation of ^{3}H-TMP into DNA by bone marrow extracts of irradiated animals was essentially unchanged. Inhibition of this process was noted beginning with 4 hrs after irradiation. The maximum decrease in the incorporation of ^{3}H-TMP was detected after two days. A tendency for restoration of the incorporation of precursors of DNA was detected beginning with the third day after irradiation. (tr-auth)

32481 (AEC-tr-7571, pp 24-29) PECULIARITIES OF THE PENETRATION OF FRAGMENTS OF DNA INTO THYMOCYTES OF IRRADIATED RATS IN VITRO. Shutko, A. N.; Shatinina, N. N. (Central Scientific Research Roentgenoradiological Inst., Leningrad). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 181-184(1974).

The kinetics of the incorporation of fragments of homologous DNA with molecular weight in the range $1 \cdot 10^5$ to $1.4 \cdot 10^3$ daltons into the thymocytes of control and irradiated rats was studied in vitro. It was shown that the process of incorporation of the substrate into the cells is not directly determined by the state of DNA synthesis de novo, and is accomplished by its periodic reversible binding to the nuclei during the process of incubation. At a dose of x irradiation of 800 rad, no damages to the indicated process were detected, while at a dose of 1200 rad, a decrease in the total amount of material incorporated into the nucleus was observed, accompanied by a distortion of the periodic character of the process. (tr-auth)

32482 (AEC-tr-7571, pp 36-42) DISTURBANCE OF CERTAIN ASPECTS OF THE PROCESS OF BIOENERGETICS IN THE ADRENAL GLANDS OF ANIMALS AFTER ACUTE RADIATION LESION. Musagalieva, G. M.; Uteshev, A. B. (Kazakh Scientific Research Inst. of Oncology and Radiology, Alma Ata, USSR). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 190-194(1974).

In differential centrifugation on a VAK-40, intracellular granules S_2 and S_3 were obtained from the adrenal medulla of guinea pigs. The change in the concentration of cytochromes, ATP, and the ATPase activity were studied at various periods after irradiation at a dose of 500 R. The data obtained are discussed in the light of the disturbance of the permeability of the cell membranes after radiation lesion. (tr-auth)

32483 (AEC-tr-7571, pp 43-47) INDICATION OF SHORT-TERM AND LONG-TERM DISORDERS IN THE METABOLISM OF IRRADIATED ANIMALS BY A STUDY OF THE "SIALIC TEST". Malashevich, E. V.; Cherkasova, L. S. (Inst. of Physiology, Minsk). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 195-198(1974).

Materials on the characterization of the state of sialic acid metabolism in the brain, liver, myocardium, and blood serum of rats subjected to 20- and 50-week chronic γ irradiation and 10- and 20-week fractionated x irradiation at a summary dose of 50 rad are cited. The role of the conditions of irradiation, the time factor, and the dose rate in the radiation response of the indicated tissues is demonstrated. The dependence of the radiation response on the intensity of processes of repair and possible mechanisms of the compensation for metabolic changes that occur after irradiation are discussed. (tr-auth)

32484 (AEC-tr-7571, pp 48-56) INVESTIGATION OF THE MECHANISMS OF THE THIOL-INCREASING EFFECT OF SEROTONIN AND ITS RELATIONSHIP TO THE RADIOPROTECTIVE ACTION. Kulinskii, V. I.; Murskikh, A. P. (Krasnoyarsk Medical Inst., USSR). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 199-205(1974).

The thiol-increasing effect (TIE) of serotonin is prevented both by D- and by M-serotoninolytics, but not by typindol. Pyrilen (pempidine) nullifies the TIE of serotonin in a dose of 5 mg/kg, but not 50 mg/kg. Dihydroergotamine prevents the TIE of serotonin, adrenalin, and theophylline. Probably the TIE of medium doses of serotonin is mediated by the liberation of catecholamines, followed by the incorporation of 3',5'-AMP. The TIE of cocaine and imipramine can be explained by the accumulation of free, undeposited monoamines. On the whole, the TIE of serotonin is satisfactorily correlated with its radioprotective effect. (tr-auth)

32485 (AEC-tr-7571, pp 57-61) ROLE OF ENDOGENOUS SUBSTANCES IN THE CREATION OF A BACKGROUND OF INCREASED RADIORESISTANCE. Communication 4. Investigation of the Influence of Serotonin on Lipid Radiosensitizers. Sobolev, A. S.; Orekhov, A. N.; Deev, L. I.; Goncharenko, E. N.; Kudryashov, Yu. B. (Moscow State Univ.). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 206-209(1974).

Serotonin in vivo induces a decrease in the content of peroxides of unsaturated fatty acids, endogenous lipid radiosensitizers, capable of increasing the effect of radiation on animals, cells, molecules, etc., in the rat small intestine. Serotonin in vitro reduced radiolysis and decomposition of solutions of β-carotene without irradiation in oxidized oleic acid, a substance simulating the action of lipid radiosensitizers. This protective action was shown to be associated with a direct interaction of serotonin with peroxides. The possible role of this process in vivo is discussed. (tr-auth)

32486 (AEC-tr-7571, pp 62-67) ROLE OF ENDOGENOUS SUBSTANCES IN THE CREATION OF A BACKGROUND OF INCREASED RADIORESISTANCE. Communication 5. Mechanisms of the Change in the Level of Lipid Oxidation Products in the Presence of the Radioprophylactic Effect. Goncharenko, E. N.; Kudryashov, Yu. B.; Zhat'kova, G. S.; Samoilikova, T. I. (Moscow State Univ.). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 210-214(1974).

Data are presented on the influence of radioprophylactic substances on certain mechanisms of the formation and maintenance of the level of endogenous lipid radiosensitizers. It was shown that the formation of secondary lipid radiotoxins can be inhibited with the aid of radioprophylactic substances. The data obtained permit assumption of an increase in the stability of the intracellular structures under the influence of radioprotective substances, which may also affect the intensity of the formation of lipid oxidation products in the membranes. (tr-auth)

32487 (AEC-tr-7571, pp 68-72) INVESTIGATION OF THE RADIOPROTECTIVE ACTIVITY OF AMINOALKYLTHIURONIUM COMPOUNDS AND THEIR HETEROCYCLIC DERIVATIVES. Nekrasova, I. V.; Mandrugin, A. A.; Gintsburg, E. I.; Tarasenko, A. G.; Fedoseev, V. M.; Graevskii, E. Ya. (Inst. of Developmental Biology, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 215-218(1974).

Aminoalkylthiuronium compounds and their heterocyclic derivatives exhibit a distinct radioprotective action in experiments on mice. In view of the fact that the radioprotective activity decreases from aminoalkylthiuronium compounds to the corresponding heterocycles, and the toxicity increases, it can be assumed that aminoalkylthiuronium compounds are the less toxic transport form of the corresponding heterocycles. (tr-auth)

32488 (AEC-tr-7571, pp 96-103) INFLUENCE OF INTERFERON INDUCERS ON THE DEVELOPMENT OF RADIATION SICKNESS IN MICE AFTER IRRADIATION WITH HIGH-ENERGY PROTONS. Talash, M. Ya.; Savchenko, N. Ya.; Shein, V. I.; Fedorenko, B. S.; Ryzhov, N. I.; Konstantinova, I. V. (Microbiological Research Group, Budapest). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 237-241(1974).

Mice were irradiated with 645 MeV protons, and the interferon content was determined after the administration of E. coli endotoxin, a double-stranded complex of polyribocytidylic and polyriboinosinic acids (poly I:C), and Newcastle disease virus (NDV). On the first day after irradiation, interferon synthesis was sharply increased when the animals were given endotoxin and NDV, but on the fourth and seventh days it was inhibited. The administration of NDV after irradiation does not influence the formation of virus-specific antibodies. The use of interferon inducers before irradiation at periods of maximum accumulation of interferon in the blood and cells of the reticuloendothelial system promoted a 2 to 2.5-fold increase in the number of karyocytes of the femur, regardless of the type of inducer used, and did not influence the number of karyocytes in the case of the administration of interferon inducers one day after irradiation. (tr-auth)

32489 (AEC-tr-7571, pp 104-110) RADIOPROTECTIVE PROPERTIES OF DISEROTONIN ESTERS OF DICARBOXYLIC ACIDS. Vasin, M. V.; Antipov, V. V.; Suvorov, N. N.; Morozovskaya, L. M.; Il'ina, G. N. Aug 1974. Translated from Radiobiologiya; 14: No. 2, 242-246(1974).

It was shown in experiments on mice that O-acylation of serotonin by dicarboxylic acids with the formation of diesters does not lead to any decrease in the radioprotective activity of the radioprotector. Lengthening the alkyl chain of aliphatic dicarboxylic acids causes an increase in the toxicity of the compound. O-acylbishydroxytryptamines exhibit a more prolonged radioprotective effect than serotonin and mexamine. In the case of intraperitoneal injection 1 hr before γ irradiation, the most active compounds: O,O'-sebacoyl-bis-5-hydroxytryptamine and O,O'-terephthaloyl-bis-5-hydroxytryptamine — protected 51.8 to 55.1% of the mice, compared with a 95.1% mortality of the animals in the control irradiated group. (tr-auth)

32490 (AEC-tr-7571, pp 116-124) DAMAGING EFFECT OF REPEATED EXTERNAL GAMMA IRRADIATION IN CONJUNCTION WITH LOCAL IRRADIATION OF THE THYROID GLAND WITH RADIOACTIVE ^{131}I CONSIDERING LONG-TERM CONSEQUENCES. Vasilenko, I. Ya.; Klassovskii, Yu. A.; Krasnokutskii, V. M.; Kaganov, V. M.; Lagun, M. A.; Miloserdov, A. P.; Il'chenko, E. F. (Inst. of Biophysics, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 251-256(1974).

The action of repeated external γ irradiation (250 R) in conjunction with local irradiation of the thyroid gland with ^{131}I (2.5 krad) was studied in experiments on dogs. During a period of 44 months, the clinical, hematological, functional, biochemical, immunological, and morphological indices of the animals were investigated. The condition of the dogs subjected to the combined lesion was better according to individual indices after the first influence than in the case of isolated γ irradiation. After the second irradiation the phenomenon of "relief" was not noted in the dogs subjected to combined irradiation. (tr-auth)

32491 (AEC-tr-7571, pp 156-159) ACTIVITY OF XANTHINE OXIDASE AND MOLYBDENUM CONTENT IN THE LIVER OF X-IRRADIATED RABBITS. Luk'yanchuk, I. I.; Gotsulyak, L. E. (Odessa Medical Inst.). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 280-282(1974).

The xanthine oxidase activity and molybdenum content in the livers of rabbits subjected to whole-body irradiation on an RUM-3 at a dose of 450 R were determined. The participation of molybdenum as an irreplaceable component in the construction and activation of many enzyme systems was previously demonstrated. It was also previously established that molybdenum directly influences the biosynthesis of proteins and nucleic acids. An analysis of the data obtained showed that x irradiation of rabbits causes an appreciable change in the xanthine oxidase activity; however, the nature of these changes depends to a great degree on the time elapsed after irradiation. (tr-auth)

32492 (AEC-tr-7571, pp 160-163) CARBONIC ANHYDRASE ACTIVITY AND THE LEVEL OF ZINC IN THE BLOOD OF X-IRRADIATED RABBITS. Luk'yanchuk, I. I.; Gotsulyak, L. E. (Odessa Medical Inst.). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 282-285(1974).

The influence of x rays at a dose of 450 R on the carbonic anhydrase activity of the erythrocytes and the zinc content in whole blood of rabbits was investigated. (tr-auth)

32493 (AEC-tr-7571, pp 164-166) INVESTIGATION OF THE INFLUENCE OF AMINOETHYLISOTHIURONIUM AND 2-AMINOTHIAZOLINE ON THE LEVEL OF PROTEIN THIOLS IN BONE MARROW CELLS OF MICE. Dontsova, G. V.; Smirnova, I. B.; Sokolova, O. M. (Inst. of Developmental Biology, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 285-287(1974).

The influence of AET and 2-AT on the level of protein thiols in the bone marrow cells of γ-irradiated mice was studied. (tr-auth)

32494 (AEC-tr-7571, pp 171-173) INVESTIGATION OF THE CELL MECHANISM OF THE RADIOPROTECTIVE ACTION OF MEXAMINE ON THE COLONY-FORMING ELEMENTS OF THE BONE MARROW. Bogatyrev, A. V.; Nikanorova, N. G.; Timoshenko, S. I.; Sverdlov, A. G. (Inst. of Nuclear Physics, Leningrad). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 290-292(1974).

The direct action of mexamine on the colony-forming ability of bone marrow cells irradiated in vitro is evidence of the fact that it protects the bone marrow, acting directly on the cells. Cystamine, cystaphos, AET, and gammaphos gave similar results. (ERB)

32495 (AEC-tr-7571, pp 174-176) SPECIES SPECIFICITY OF INTERFERON AS AN INDICATION OF CHIMERISM OF THE HEMOPOIETIC TISSUE OF RADIATION CHIMERAS. Mentkevich, L. M.; Shcheglovitova, O. N.; Amchenkova, A. M. (Inst. of Epidemiology and Microbiology, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 293-294(1974).

The formation of rat serum interferon in the bodies of xerogenic chimeras (rat → mouse) was demonstrated by De Maeyer-Guignard, et. al. Nucleated bone marrow cells of xerogenic chimeras form rat interferon in response to the introduction of Newcastle disease virus (NDV). These data permitted hypothesis that the determination of the species specificity of interferon can serve as a supplementary test for establishing the status of xerogenic chimerism. (tr-auth)

32496 (AEC-tr-7571, pp 177-180) SOME DATA ON THE SIGNIFICANCE OF THE HEMOPOIETIC TISSUE IN THE MECHANISM OF 3.5 TO 5 DAY DEATH OF RATS UNDER THE CONDITIONS OF NONUNIFORM IRRADIATION. Fedorovskii, L. L. (Inst. of Biophysics, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 295-297(1974).

The influence of partial shielding of the hemopoietic tissue, or autotransplantation of the bone marrow on the survival, leukocyte content in the peripheral blood, and state of the intestines in rats with nonuniform irradiation, causing 3.5 to 5 day death of the animals was studied. (tr-auth)

32497 (AEC-tr-7571, pp 181-185) POSSIBILITY OF THE PRACTICAL UTILIZATION OF A GASEOUS HYPOXIC MIXTURE FOR THE PROPHYLAXIS OF RADIATION SICKNESS. Strelkov, R. B.; Bryantseva, L. A.; Ziya, A. V. Aug 1974. Translated from Radiobiologiya; 14: No. 2, 297-301(1974).

On the basis of the available literature data, calculations were made and a method proposed of prophylaxis of radiation sickness, using the "oxygen effect," and considering the shortcomings of the chamber method of creation of tissue hypoxia. The principal distinction of the method is the provision of a low level of pO_2 in the tissues of the organism through the inhalation of a gas mixture containing 10% oxygen and 90% nitrogen, which is delivered through a hose and mask directly to the respiratory organs. This makes independent movement of the person to be protected over the locality possible under the condition of delivery of the gaseous hypoxic mixture from a portable container. A gas mixture containing 10 to 12% oxygen, even in unconditioned persons, does not cause any side effects or discomfort for a period of 15 to 20 min, a time quite sufficient, for example, for the performance of x-ray diagnostic procedures or a session of radiation therapy. An experimental verification of the effectiveness of the proposed method was performed according to two criteria: the survival of the animals protected with the gaseous hypoxic mixture (GHM) by 30 and 60 days after irradiation was determined, and the influence of the GMH on the level of oxygen tension in the tissues of mammals was determined by means of polarography. (tr-auth)

32498 (AEC-tr-7571, pp 186-190) PRODUCTION OF AUTOANTIBODIES FROM ORGANS OF IRRADIATED DOGS AND THEIR USE IN THE TREATMENT OF ACUTE RADIATION SICKNESS OF RABBITS. Shal'nova, G. A.; Klemparskaya, N. N. (Inst. of Biophysics, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 301-304(1974).

Eluates containing antitissue antibodies were extracted from the organs of irradiated dogs and injected subcutaneously into male rabbits at various times after γ irradiation. The results indicate that autoantibodies eluted from tissues of irradiated dogs have a pronounced therapeutic effect in acute radiation sickness. (ERB)

32499 (AEC-tr-7571, pp 191-195) INVESTIGATION OF CERTAIN QUESTIONS OF THE RADIOPROTECTIVE ACTION OF S-[N-(3-AMINOPROPYL)-2-AMINOETHYL]-THIOPHOSPHORIC ACID. Sverdlov, A. G.; Grachev, S. A.; Bogatyrev, A. V.; Shabarova, A. I.; Bagiyan, G. A.; Timoshenko, S. I. (Inst. of Nuclear Physics, Leningrad). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 304-307(1974).

The radioprotective activity of S-[N-(3-aminopropyl)-2-aminoethyl]-thiophosphoric acid in the case of x irradiation of mice was studied. (tr-auth)

32500 (AEC-tr-7571, pp 196-199) REPEATED X IRRADIATION OF DOGS UNDER CONDITIONS OF PROTECTION WITH CYSTAMINE. Kavukchyan, T. V.; Bogatyrev, A. V.; Sverdlov, A. G. (Inst. of Nuclear Physics, Leningrad). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 308-310(1974).

Mature dogs were x-irradiated four times at a dose of 200 R (total dose 800 R) at seven-day intervals. Five minutes before irradiation the dogs received 100 mg/kg of cystamine hydrochloride intravenously. The results indicate that the preliminary administration of cystamine provides a good protective effect, increasing survival and reducing the clinical manifestations of radiation sickness. (ERB)

32501 (AEC-tr-7571, pp 200-204) RADIOPROTECTIVE ACTION OF BACTERIOPHAGE T2 IN EXPERIMENTS ON MICE. D'yachenko, A. G.; Dikovenko, E. A.; Elistratova, Zh. V.; Vasil'chenko, V. N. (Inst. of Experimental Pathology and Therapy, Sukhumi, USSR). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 310-314(1974).

The administration of bacteriophage T2 to mice prior to irradiation with γ rays at doses of 700, 800, 900, and 1000 R had a significant protective effect. This effect was demonstrated not only by increased survival, but also by the positive influence on the course of recovery processes in the hematogenic organs of irradiated animals. (ERB)

32502 (AED-CONF-72-616-001, pp 125-137) ATYPICAL REACTIONS IN THE PRE-IRRADIATED RAT LIVER. Oehlert, W.; Nuss, A.; Lesch, R. 1973. (In German).

From meeting of the Schutzkommission beim Bundesministerium des Innern; Freiburg, F. R. Germany (12 May 1972).

2 figs.; 2 tabs. Available from ZAED.

In Schutzkommission of the Federal Ministry of the Interior.

In order to verify the assumption that the parenchyma of a pre-irradiated liver will exhibit changes not only in the regeneration mechanism but also in other reactions, male white Wistar rats received a single selected, percutaneous deep x-irradiation of the liver amounting to a total of 800 R. At various intervals following irradiation, a second liver lesion was created by means of allyl alcohol poisoning and application of galactosamine. The usual histological picture of such a liver lesion is described. The animals treated with galactosamine 1 d or 1 week after pre-irradiation developed the usual form of hepatitis, whereas the hepatitis observed in animals injected with galactosamine 3 months after pre-irradiation showed quite a different histologic picture. The animals developed an atypical hepatitis, which was found to be protracted and changed into a chronic alteration. (GE)

32503 (BMVg-FBWT-72-16) BIOLOGICAL EFFECTS OF FAST NEUTRONS. Mortality and Changes in the Blood Picture of Mice After Whole-Body Irradiation With Fast Neutrons and X-Rays. Otto, F. J. (comp.). (Bundesministerium fuer Verteidigung, Bonn (F. R. Germany). Dokumentationszentrum der Bundeswehr; Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Grafschaft/Hochsauerland (F. R. Germany). Inst. fuer Aerobiologie). Dec 1972. 19p. (In German).

The biological effects of fast neutrons of the energy range 2 to 6 MeV were studied in NMRI mice and compared with the effects of x rays. The total mortality after 30 days, the patterns of mortality, and the changes in blood cell count were tested. The LD_{50} of neutrons is 293 rad, the LD_{50} of x rays is 479 rad. The relative biological effectiveness of neutrons in mortality response is 1.6 to 1.7. The RBE values decrease with increasing dose. After neutron-irradiation, death occurs earlier and the variations in death time are greater than after x irradiation. The decrease of lymphocyte number 48 hours after irradiation shows a linear relation to dose logarithm. Lymphocyte number as a measure of radiation damage is sure and useful over a wide dose range. The relative biological effectiveness of neutrons in lymphocyte decrease is 2.0 after low doses and 1.4 after high doses. The number of reticulocytes decrease 48 hours after neutron irradiation. Counting the reticulocytes is difficult because of the uncertain methods. (auth)

32504 (COO-3167-107) RADIATION AND RADIOISOTOPE STUDIES WITH LABORATORY AND DOMESTIC ANIMALS. RADIATION EFFECTS ON REPRODUCTION AND EMBRYOGENESIS. Progress Report, June 1, 1973-May 31, 1974. DuFrain, R. J.; Casarett, A. P. (Cornell Univ., Ithaca, N. Y. (USA); New York State Veterinary Coll., Ithaca (USA). Dept. of Physical Biology). 1974. Contract AT(11-1)-3167. 52p. Dep. NTIS $5.75.

Separate abstracts were prepared for the three sections of this report. (CH)

For abstracts of individual sections see: 32505-32507.

32505 (COO-3167-107, pp 1-9) RADIATION AND RADIOISOTOPE STUDIES WITH LABORATORY AND DOMESTIC ANIMALS: RADIATION EFFECTS ON REPRODUCTION AND EMBRYOGENESIS. DuFrain, R. J.; Casarett, A. P. 1974.

In radiation effects on reproduction and embryogenesis. Progress report, June 1, 1973-May 31, 1974.

Fertilized mouse embryos were irradiated in vitro and their development to blastula was followed. Radiation was given at selected stages of embryo development from one-cell to blastula, acutely from external x or γ sources or chronically either from external γ sources or from radionuclides ($^{90}Sr-^{90}Y$, ^{3}H) incorporated into the culture medium. Observations of cleavage times and morphologic development were made at intervals throughout the four-day culture period. Radiosensitivity was generally determined by survival to blastocyst stage, with other endpoints used as appropriate. Other embryos were exposed in vivo to the same treatments, and blastocyst development was determined. Radiation was given to parents for one or more generations prior to mating. The embryos were then studied from two-cell to blastula in the culture system, with particular emphasis on the development from morula to blastula (since cavitation requires genomic expression). Parents were irradiated with external acute γ radiation, by continuous exposure to tritium incorporated into drinking water, or by a single injection of $^{90}Sr-^{90}Y$. Radionuclide distribution, organ dose, gonadal effects, and sperm parameters were measured in certain experiments to supplement studies of effects on embryos. (auth)

32506 (COO-3167-107, pp 10-47) CELL CYCLE STAGE DETERMINATION FOR THE FOUR-CELL MOUSE EMBRYO AND EFFECTS OF IRRADIATION DELIVERED AT DIFFERENT TIMES OF THE FOUR-CELL STAGE CELL CYCLE. DuFrain, R. J.; Casarett, A. P. 1974.

In radiation effects on reproduction and embryogenesis. Progress report, June 1, 1973-May 31, 1974.

Estimates made of the duration of the four-cell stage in mouse embryos in cultures gave an average time of 14.5 hours. The developmental progression through morula, beginning of blastocoel formation, blastocyst maintenance in the expanded condition, initiation of hatching, and completion of hatching was observed for embryos x irradiated at the two-cell stage, four different times during the four-cell stage, and at the eight-cell stage. Data obtained was analyzed using a logistic model to describe the radiation induced developmental arrest of the mouse embryos cultured in vitro. From this logistic model, various relative radiosensitivities were determined for irradiation delivered to different numbers of cells and for irradiation delivered at various times during a specific cell stage. A qualitative evaluation of cleavage delay was made by assessing the dose dependent reduction in cell number (relative to control values) at a specific time in the developmental sequence monitored. The results obtained are tentatively explained in terms of known or postulated molecular events that occur or have been postulated to occur during the preimplantation period of development of the mouse embryo. (CH)

32507 (COO-3167-107, pp 48-51) ALLOPHENIC EMBRYOS FOLLOWING IRRADIATION OF ONE OF THE FUSED MOUSE EMBRYOS. Chaffee, S.; DuFrain, R.; Casarett, A. P. 1974.

In radiation effects on reproduction and embryogenesis. Progress report, June 1, 1973-May 31, 1974.

Genetic mosaicism in mice was produced by the fusion of two cultured embryos during the cleavage period of the fertilized egg. The blastomeres of the eggs were distinguished from each other by labeling one with tritiated thymidine. The relative contribution of each embryo to the resulting blastocyst was determined by autoradiography following slide preparation. When one of the embryos was irradiated prior to fusion, it was possible to determine the effect of this irradiation on the contribution of the embryo to the blastocyst. Preliminary results are reported from experiments in which embryos were labeled, irradiated, and their contribution to the blastocyst assessed. (auth)

32508 (GSF-B-367) SYNERGISTIC EFFECT OF RADIATION INDUCED MUTATIONS ON THE VIABILITY OF CERTAIN GENOTYPES. Schroeder, J. H. (Gesellschaft fuer Strahlen- und Umweltforschung m. b. H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Biologie). May 1972. 11p. (In German). (AED-CONF-72-556-001; CONF-7205112-1).

From workshop for genetics of the GSF; Neuherberg/Munich, F. R. Germany (4 May 1972).

32509 (LA-5722-MS) DOSE-RATE EFFECT ON LIFE SHORTENING IN MICE. Spalding, J. F.; Johnson, O. S.; Archuleta, R. F.; Tietjen, G. L. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1974. Contract W-7405-eng-36. 5p. Dep. NTIS $4.00.

An adult population of strain RF female mice was conditioned with thirteen discrete doses of ^{60}Co γ rays ranging from 457 to 3455 rad given at a dose rate of 2.76 rad/h. Median after-survival times of conditioned groups were compared with control nonconditioned groups to determine life-shortening effects of γ rays given at a relatively low dose rate. No linear dependence of life shortening on dose was observed. The average life shortening for all conditioning doses used was 83 days (0.04 day/rad). The relatively small life-shortening effects observed were attributed to several factors, including age at exposure and dose rate, and not to dose rate alone. (auth)

32510 (LA-5724-MS) RECOVERY AND RESIDUAL INJURY IN MONKEYS EXPOSED TO LARGE DOSES OF RADIATION BY FRACTIONATION. Spalding, J. F.; Holland, L. M.; Johnson, O. S.; Prine, J. R.; London, J. E.; LaBauve, P. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1974. Contract W-7405-eng-36. 7p. Dep. NTIS $4.00.

The target site and nature of the long-term residual lesion (LTRL) caused by exposure to ionizing radiations are not well understood. Monkeys (Macaca mulatta) were given 100-rad conditioning doses of γ rays at 56-day intervals to accumulate 2400 rad. Eighty-four days after the 24th conditioning exposure, the monkeys were challenged to death with continuous low-dose-rate γ rays. The response of hematopoietic tissue was observed as the primary site of acute and long-term radiation injury. Hemograms were performed on monkeys during the fractionation radiation regime used to administer conditioning doses and dur-

ing the subsequent continuously delivered challenge exposures. The hematopoietic recovery rate from radiation injury was found to be independent of total accumulated γ dose. The LTRL from γ conditioning doses totaling 2400 rad did not significantly decrease the mean survival time (MST) in a radiation field of 24 rad/23.5-hr day. (auth)

32511 (ORO-719) CONSUMABILITY OF ANIMALS EXPOSED TO RADIATION IN A POST ATTACK SITUATION. Preliminary Report, February 1–September 30, 1972. Eisele, G. R. (UT-AEC Agricultural Research Lab., Oak Ridge, Tenn. (USA)). Jun 1973. Contract AT-40-1-GEN-242. 37p. Dep. NTIS $5.50.

The utilization of meat for human consumption from animals exposed to lethal irradiation was examined. The initial objective was to determine if lethally irradiated pigs develop bacteremia and if subsequent invasion of the organs and muscles occurs. Pigs weighing approximately 90 to 113 kg. were subjected to a total dose of 966 R, at a rate of 10.5 ± .6 R/hr. of gamma radiation from a ^{60}Co source over a four day period. At determined intervals blood samples were obtained from all animals for bacteriologic examination. Muscle (ham–semimembranosus and/or biceps femoris, loin–longissimus dorsi, shoulder–teres major), liver, spleen, lung, kidney and numerous lymph nodes were subjected to bacteriologic examination when the animals were terminated. Concurrently, hematologic and blood chemistry studies were made and rectal temperatures were determined to investigate the possible relation of these procedures with the status of the animals. A bacteremic state was not detected in one animal while another yielded positive isolates twice. The bacteremia, however, was transient in the remaining animals and was not detected at earlier or later sampling dates. At slaughter the irradiated animals yielded greater numbers and genera of bacteria from the muscles and organs than their respective controls. The loin and shoulder muscle had a lower incidence of microbial recovery than the ham. A decrease in numbers of thrombocytes, lymphocytes, and neutrophils occurred in the blood of irradiated animals. Neither rectal temperatures nor blood chemistry revealed sufficient data to indicate the optimum slaughtering time. (auth)

32512 (PB-231184) CSU–PHS COLLABORATIVE RADIOLOGICAL HEALTH LABORATORY ANNUAL REPORT, 1972. (Bureau of Radiological Health, Rockville, Md. (USA)). Jan 1973. Contract FDA-72-302. 159p. (DHEW/FDA-74-8017). NTIS $5.00.

The Collaborative Radiological Health Laboratory was conceived in 1962 as a joint operation between the Division of Biological Effects, (Bureau of Radiological Health), FDA, and the Department of Radiology and Radiation Biology, Colorado State University, to conduct a long-term study of effects on the beagle of low-level gamma exposure. The first section summarizes current investigations at the prenatal, neonatal, and adolescent stages. The second section describes studies on the adult animal, including measurement of organ function, disease evaluation, and management experience, and provides the foundation for major experimental work. A list of publications from 1964 through 1972 is included. (GRA)

32513 (PB-231429) FUNCTIONAL ACTIVITY OF NAOMAL ISOGENIC MOUSE BONE-MARROW CELLS TESTED BY QUANTITATIVE TRANSPLANTATION INTO IRRADIATED CBA MICE. I. Correlation Between Cell Dose and Survival 30–90 Days After Irradiation. Unsgaard, B. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Jan 1974. 32p. (ISBN-91-7056-026-9). NTIS $4.75.

An attempt was made to evaluate the usefulness of survival of lethally irradiated mice for testing the functional integrity of preparations of bone marrow cells. CBA mice were used, and isogenic bone-marrow cells were administered intravenously or intraperitoneally. Altogether 6993 mice were irradiated (1092 R). Bone-marrow cells were thereafter injected by the intravenous route in 2263 mice and intraperitoneally in 1770 mice. The remaining 2960 were controls. The relationship between cell dose and survival of the mice for 30 to 90 days was studied. It is concluded that, under the conditions of the experiments, survival of lethally irradiated mice could be used as a test of the functional damage to the injected bone-marrow cells. (auth)

32514 (UCD-472-121, pp 2-5) ENDOCRINE ASPECTS OF THE AFOLLICULAR (X-IRRADIATED) OVARY IN THE BEAGLE: A PRELIMINARY REPORT. Andersen, A. C.; Andersen, R. N.; Joechle, W.; Stabenfeldt, G. Jun 1974.

In annual report, fiscal year 1974.

Correlation of the estrogen response of the irradiated beagle ovary to follicle stimulating hormone was not possible. The afollicular (irradiated) ovary remained capable of elevating plasma estrogens such that following FSH : ICSH stimulation, a 5-fold increase of plasma androstenedione was observed. (auth)

32515 (UCD-472-121, pp 6-7) EFFECTS OF FRACTIONATED X-RAY EXPOSURES ON THE FETAL MONKEY (MACACA RADIATA). Andersen, A. C.; Hendrickx, A. G.; Johnson, M. I.; Newman, L. Jun 1974.

In annual report, fiscal year 1974.

In an experiment involving 50 prenatally irradiated bonnet monkeys, 11 mothers have produced 6 female and 5 male irradiated progeny and another 8 pregnant monkeys are being irradiated. Female progeny show evidence that oöcytes in prophase meiosis, not oögonia, are severely damaged by fractionated x ray exposures of 11.5 rads (200 rads total). Five male irradiated progeny have not yet shown definitive results on testicular damage. (auth)

32516 (UCD-472-121, pp 8-9) OVARIAN DAMAGE FOLLOWING CONTINUOUS GAMMA-RAY EXPOSURE OF 4.5 R DAILY TO THE YOUNG PUP. Andersen, A. C.; Momeni, M. H.; Chrisp, C. E. Jun 1974.

In annual report, fiscal year 1974.

Three beagle pups that received 4.5 R daily of ^{60}Co γ radiation as fetuses during the period of oogenesis (birth to 60 days of age) exhibited severe follicle damage when examined at one year of age. Ovaries from the irradiated beagles had a 98% reduction in follicles as compared to sham-treated controls. (auth)

32517 (UCD-472-121, pp 10-12) STERILITY IN MALE BEAGLES SUBJECTED TO "LOW LEVEL" CONTINUOUS ^{60}Co-IRRADIATION. Johnson, M. I. Jun 1974.

In annual report, fiscal year 1974.

Male beagles subjected to continuous ^{60}Co γ irradiation were judged sterile by morphologic and functional parameters. Animals from 63 days post-conception to 60 days of age received 5 R/22-hr day totaling 265 ± 12 R. Others received 5 R or 1.67 R/day from 6 wks of age until doses of ~970 or 890 R had been accumulated. One dog received 0.85 R/day from 6 weeks of age until approximately 480 R was accumulated. (auth)

32518 (UCD-472-121, pp 13-17) STATUS OF ^{60}Co PILOT STUDY. MacMillan, K. L.; Wilson, F. D.; Fisher, G. L.; Chrisp, C. E. Jun 1974.

In annual report, fiscal year 1974.

The ^{60}Co γ field pilot study of exposed beagles is reviewed with respect to clinical and hematologic status, serum trace element analysis, and bone marrow stem cell studies of exposed beagles in vitro. In addition, one animal manifesting a radiation-induced myeloproliferative disorder is reviewed in greater detail. (auth)

32519 (UCD-472-121, pp 40-59) HEMATOLOGIC EFFECTS: AN OVERVIEW. Wilson, F. D.; Goldman, M.; Chrisp, C. E.; Rosenblatt, L. S.; McNeill, C. J.; Munn, S. L.; Shifrine, M. Jun 1974.

In annual report, fiscal year 1974.

A multiparametric program was developed to document the effects of continuous irradiation from the internal emitters ^{90}Sr and ^{226}Ra on the hematopoietic system, as well as for ^{60}Co whole-body γ exposure. In addition to routine peripheral blood studies, data are being accumulated on serial bone marrow samples using standard morphologic techniques. Recently, techniques have been developed using methylcellulose culture systems that allow for quantitation of bone marrow stem cell populations as well as for the bioassay for serum level of colony stimulating factor (CSF–a candidate granulopoietin). Studies utilizing these techniques have been initiated to determine the effects of chronic irradiation on these parameters in beagles. Where possible, special studies such as ^{59}Fe ferrokinetics and ^{52}Fe positron scanning have also been applied to the documentation of such injury. (auth)

32520 (UCD-472-121, pp 76-79) TRACE ELEMENT CHANGES IN RADIATION-RELATED AND SPONTANEOUS DISEASE STATES: A PRELIMINARY REPORT. Fisher, G. L. Jun 1974.

In annual report, fiscal year 1974.

Elevated serum copper levels (SCL) were found in dogs with epilepsy and bacterial and viral infections; depressed SCLs in castration and hysterectomy. Serum zinc level (SZL) elevation was found in environmentally stressed animals. Elevated SCLs and SZLs were found in dogs with radioinduced osteosarcomas with decreases to normal values post amputation. (CH)

32521 RELATIVE BIOLOGICAL EFFICIENCY OF 400-MeV NEUTRONS: ANALYSIS OF LESIONS OF THE CRYSTALLINE LENS IN THE RAT. Di Paola, M.; Bianchi, M.; Baarli, J. (CNEN, Casaccia, Italy). Med. Nucl. -Radiobiol. Lat., Suppl.; 5: No. 5, 191-192(1971). (In Italian).

Male rats were exposed to a pure beam of 400 MeV neutrons or a

beam attenuated by a polythene film at a dose of 5 to 58 rads or to doses of 50 to 400 rads of 250-kV x rays. The rats were examined periodically after irradiation for the degree of opacity of the crystalline lens. From a comparison of the effects produced by the x rays, the RBE of a pure neutron beam is of the order of 5.8 and 2.2 for the attenuated beam. (JSR)

32522 RESCUE FROM CANINE GRAFT-VERSUS-HOST REACTION BY AUTOLOGOUS OR DL-A-COMPATIBLE MARROW. Storb, R.; Epstein, R. B.; Graham, T. C.; Kolb, H. J.; Kolb, H.; Thomas, E. D. (Univ. of Washington, Seattle). Transplantation; 18: No. 4, 357-367(Oct 1974).

The present study is concerned with the termination of chimerism in canine marrow recipients threatened by lethal graft-versus-host (GVH) disease with use of an infusion of stored autologous marrow cells or cells from serotypically histocompatible littermates. All recipients were given 1,200 R of total-body irradiation followed by a hemopoietic graft from a histoincompatible unrelated donor. Methotrexate was given on days 1, 3, 6, and 9 to delay the onset of GVH disease. Five dogs given no additional therapy died between 16 and 39 days with GVH disease. An attempt at rescue was made in 10 dogs by giving an infusion of stored autologous marrow on day 14 either with or without exposure of the recipient to 400 R. Rescue failed, and dogs died between 18 and 37 days either with GVH disease or marrow aplasia. Rescue was successful in three of seven dogs given 600 R on day 14 followed by infusion of marrow from a compatible littermate. The remaining four dogs either rejected the littermate marrow or died of infection. In conclusion, attempts at rescue from canine GVH disease are exceedingly difficult, and only possible in the present study after renewed exposure of the recipient to a high dose of total-body irradiation followed by large numbers of hemopoietic cells from a compatible littermate. (auth)

32523 ALLOTRANSPLANTATION OF LUNG WITHOUT IMMUNOSUPPRESSION AFTER TRANSPLANTATION. I. Staged Transplantation of Bone Marrow and Lung. Blumenstock, D. A.; Kazemi, H.; Hales, C. A.; Cannon, F. D.; Zumwalt, R.; Ferrebee, J. (Mary Imogene Bassett Hospital, Cooperstown, NY). Contract AT(11-1)-3327. Transplantation; 18: No. 4, 336-342(Oct 1974).

Six of 12 animals are alive 8 to 22 months after transplantation. Five of these animals and one which died of streptococcal pneumonia after pulmonary function testing demonstrated adequate pulmonary function in the transplant. One living recipient has not been studied. Four animals died of a "wasting syndrome" thought to be related to radiation damage to the pancreas rather than graft-versus-host reaction. One animal was killed with a severe skin eruption of unknown cause. (auth)

32524 GRAFT-VERSUS-HOST DISEASE. Modification With Concanavalin A. Tyan, M. L. (Univ. of North Carolina, Chapel Hill). Transplantation; 18: No. 4, 305-312(Oct 1974).

Myeloid and erythroid precursors (colony-forming units) are more resistant to the toxic effects of in vitro incubation with concanavalin A than are mature immunocompetent cells. When allogeneic bone marrow and spleen cell preparations that contain adequate numbers of colony-forming units are incubated in vitro with concanavalin A at concentrations sufficient to kill and/or inhibit immunocompetent cells, and then are injected into irradiated hosts, a majority of marrow stem cells survive to protect the recipients against the effects of the radiation, and graft-versus-host disease either is prevented entirely or the incidence is greatly reduced. (auth)

32525 STERILE PERIOD, TRANSLOCATION, AND SPECIFIC LOCUS MUTATION IN THE MOUSE FOLLOWING FRACTIONATED X-RAY TREATMENTS WITH DIFFERENT FRACTIONATION INTERVALS. Cattanach, B. M.; Moseley, H. (MRC Radiobiology Unit, Harwell, Eng.). Mutat. Res.; 25: No. 1, 63-72(Oct 1974).

The genetic response of the mouse spermatogonial stem cell to high doses of x rays given in two fractions is dependent upon the fractionation interval. When 800 R was administered in two fractions, 500 plus 300 R, separated by intervals varying from 24 h to 12 days, the recovered translocation yield was consistent with additivity. However, with intervals of 3 to 12 days, the response was less than additive and was closer to that of the single 800 R dose. When 1000 R was administered in two fractions of 500 R separated by intervals of 4 days and 7 days, the recovered yield of specific locus mutations approximated the additive levels. There was no enhancement of the response, as obtained with 24-h fractionation. In neither experiment was there an indication of any kind of correlation with stem cell killing, as indicated by length of sterile period. It is proposed that the results could be interpreted on the assumption of a spermatogonial stem cell having a long cell cycle (several days) such that in the first two days following one radiation exposure the surviving cells are particularly sensitive to the induction of both gene mutations and translocations by a second treatment. It is further suggested that the relative response of gene mutation and translocation to fractionated treatments is essentially the same but approximately half of those cells carrying translocations are eliminated by selection. (auth)

32526 SPERMATOGONIAL STEM CELL KILLING IN THE MOUSE FOLLOWING SINGLE AND FRACTIONATED X-RAY DOSES, AS ASSESSED BY LENGTH OF STERILE PERIOD. Cattanach, B. M. (MRC Radiobiology Unit, Harwell, Eng.). Mutat. Res.; 25: No. 1, 53-62(Oct 1974).

When length of sterile period is taken as a measure of spermatogonial stem cell killing, the dose–response curve following x irradiation indicates the existence of two stem cell populations. It is not possible to distinguish whether these represent different cell types or different stages in the cell cycle of a single cell type but, on the basis of the published cytological and genetical evidence, the former is considered the more likely. It is suggested that the two cell populations may provide the basis for the heterogeneity of the spermatogonial stem cell, proposed as an explanation for the humped dose–response curves for genetic damage. Twenty four hour fractionated doses demonstrated diverse responses relative to the single treatments at different total doses. These suggested that the first fraction alters the relative sensitivities of the two stem cell populations to killing and/or genetic damage by the second fraction. It is concluded that (1) with higher single doses, the drop in yield of genetic damage stems, not from greater cell killing as such, but from a tendency for coincidence of genetic damage and cell killing in the same cells, (2) with 24-h fractionated treatments, the cell killing brought about by the second fraction tends to occur in different cells from those in which genetic damage had been induced by the first fraction. (auth)

32527 IRRADIATION EFFECTS ON MUSCLE MEMBRANE ACETYLCHOLINE RESPONSE. Portela, A.; Vaccari, J.; Stewart, P. A.; Perez, R. J.; Llobera, O.; Xamar Oro, R.; Perez, J. C. (Consejo Nacional de Investigaciones Cientificas y Tecnicas (CONICET), Buenos Aires). Stud. Biophys.; 43: No. 1, 57-58 (1974).

In frog muscle, x irradiation and millimolar acetylcholine concentrations each produce stable depolarizations at the order of 10 millivolts. Interactions between these two agents were investigated in the present study. Resting membrane potentials were measured in frog sartorius muscles perfused, before and after 100 kilorads of x rays, with Ringer's solutions of increasing acetylcholine concentrations, up to 5.0 mM. In 2.5 mM potassium Ringer's, acetylcholine after irradiation has no additional depolarizing action unless the expected membrane potential is lower than the post-irradiation level, in which case the same membrane potential is seen as without irradiation. Similar results are seen in cesium Ringer's. Washing with acetylcholine-free potassium Ringer's after irradiation and ACH treatment restores the potential to the preacetylcholine but post-irradiation level. These results are interpreted to indicate that x irradiation primarily damages the sodium conductance mechanism, and raises the minimum sodium conductance, but does not damage the membrane system which interacts reversibly with acetylcholine (ACH). (auth)

32528 DOSE-RESPONSE RELATIONSHIP OF SPECIFIC LOCUS MUTATIONS IN MICE. Ehling, U. H. (Gesellschaft fuer Strahlen- und Umweltforschung m. b. H., Neuherberg/Muenchen (F. R. Germany). Abt. fuer Genetik). Arch. Toxikol.; 32: No. 1, 19-25(Mar 1974).

From spring meeting of the Deutsche Pharmakologische Gesellschaft; Mainz, F. R. Germany (21 Mar 1973). 4 tabs.; 25 refs.

A linear dose-response relationship is typical of radiation-induced specific locus mutations in mice. Departure from a linear dose-effect curve was observed after a low dose of 50 R female mice and after fractionation of the dose in female and male mice. The mutation frequency after repeated exposure depends both on size of each dose and on spacing of doses. Furthermore, the mutation rate of spermatogonia drops significantly below a linear relationship with dose after x-irradiation with 1,000 R (80 to 90 R/min). Interperitoneal injection of sublethal doses of mitomycin C (MC) and tretamin (TEM) increased significantly the rate of specific locus mutations in spermatogonia of mice. These data indicate a correlation between dose and mutation frequency. It is suggested to use the specific locus method for an experimental approach to test the threshold concept of chemical agents for mutagenicity in mammals. (auth)

32529 RADIOSENSITIVITY OF T AND B LYMPHOCYTES. P. 1. Effect of Irradiation on Cell Migration. Anderson, R. E. (New Mexico Univ., Albuquerque (USA). Dept. of Pathology); Sprent, J. (Basel Univ. (Switzerland). Inst. fuer Immunologie); Miller, J. F. A. P. (Walter and Eliza Hall Inst. of Medical

Research, Parkville (Australia)). Eur. J. Immunol.; 4: No. 3, 199-203(Mar 1974).

3 figs.; 2 tabs.; 24 refs.

To study the effect of irradiation on cell migration, populations of recirculating lymphocytes consisting predominantly of either T or B lymphocytes were labeled with ^{51}Cr, exposed to various doses of irradiation in vitro and transferred intravenously to syngeneic mice. Cell recipients were killed at intervals to determine levels of radioactivity in various organs. On the basis of radioactive counts, small T lymphocytes homed normally to the lymphoid tissues within 4 h of injection (primary migration) in spite of prior exposure to heavy irradiation, e.g., 5,000 r. Primary migration, especially to the lymph nodes, was greatly reduced, however, when irradiated cells were cultured in vitro for 1-7 h before injection. This suggested that cell damage following irradiation was not manifested immediately, but developed slowly over several hours. This was supported by observations that, with cells injected immediately after irradiation, even doses as low as 50 r caused a marked reduction in secondary migration, i.e., migration occurring between 4 and 24 h after cell injection. Activated T cells proved to be more radioresistant than small T cells in that secondary migration of activated cells was not abolished, although reduced, by high doses of irradiation. B cells were found to be extremely radiosensitive. Thus, in contrast to T cells, primary migration of B cells was greatly reduced by heavy irradiation. Secondary migration of B cells, although limited, was abolished by 100 r. When lymphocytes were irradiated and placed in tissue culture for 4 days, virtually no B cells survived exposure to 300 r. This dose reduced viability of T cells by 90%. Five to 10% of T cells, however, remained viable after exposure to doses as high as 1,000 r. The results, as a whole, suggested that both T and B small lymphocytes die in interphase soon after irradiation, death occurring very rapidly with B cells, but less rapidly with T cells. Interphase death of activated T cells seemed to occur comparatively slowly. (auth)

32530 N^6-SUBSTITUTED ADENOSINE DERIVATIVES: RADIOPROTECTION, WHOLE-BODY DISTRIBUTION, AND THEIR EFFECTS ON BLOOD PRESSURE AND RESPIRATION RATES. Asakura, H. (Tokyo Univ.); Lee, K.; Ikegami, S.; Shikita, M.; Akaboshi, S. J. Radiat. Res.; 15: No. 1, 19-24 (Mar 1974).

Six derivatives of adenosine were examined for their pharmacological actions and whole-body distribution in relation to their radioprotective action. They all caused a large drop in blood pressure and slowdown of pulse rate in rats. Respiration rate was slightly decreased with concomitant over-breathing. Labeled compounds of two of these adenosine derivatives, N-(^{14}C-2-hydroxyethyl) adenosine and N-(^{35}S-2-mercaptoethyl) adenosine, were synthesized. Whole-body autoradiographic study in mice showed a significant accumulation of the compounds in liver, spleen, intestinal mucosa, and bone marrow. (auth)

32531 VIRULENCE OF DYSENTERY AMOEBAE FOR LABORATORY RATS IRRADIATED WITH VARIOUS DOSES OF X RAYS. Ailyarova, S. T. Parzitologiya; 7: 169-174(1973). (In Russian).

Fifteen strains of Endamoeba histolytica were studied for their virulence to animals irradiated and non-irradiated with x rays. It was established that after irradiation the infection rate of animals with dysentery Amoebae considerably increases as well as the virulence of E. histolytica. (auth)

32532 STUDIES ON ECTOPIC GRANULE CELLS IN THE CEREBELLAR CORTEX. P. 2. The "Date of Birth" of the Ectopic and Normal Granule Cells After Low-Level X-Irradiation. Ebels, E. J.; Peters, L. (Rijksuniversiteit Groningen (Netherlands). Div. of Neuropathology; Purdue Univ., Lafayette, Ind. (USA). Dept. of Biological Sciences). Acta Neuropathol.; 27: No. 3, 271-275(1974).

1 fig.; 1 tab.; 5 refs.

Ectopic granule cells in the cerebellar cortex were produced by low-level x-irradiation of the head 6-day old rats. The labelling pattern of ectopic granule cells after ^3H-thymidine injection at various intervals after the irradiation was compared with that of the normal cerebellar granule cells in the same animals. Both patterns were found to be essentially similar: most granule cells, regardless of their location, originated in 13 to 15-day old animals. The similarity of both patterns argues against the assumption that the ectopic granule cells form a special group of "late developers". The present results are in agreement with deductions from a hypothesis concerning the pathogenesis of ectopic granule cells put forward in a previous article. Possible implications of the results for understanding of aspects of cerebellar development are tentatively discussed. (auth)

32533 COMBINATION OF HEAT AND IONIZING RADIATION IN VIVO. Thrall, D. E. Ft. Collins; Colorado State Univ. (1974). 176p. University Microfilms Order No. 74-20,735.

Thesis (Ph. D.).

This was a study of the response of the C3H mouse mammary adenocarcinoma and C3H mouse skin to combined wet heat and x radiation administered under either ambient, hypoxic or hyperbaric oxygen conditions of local tissue oxygenation. In both the skin and tumor systems, heat reduced the radiation dose necessary to reach the endpoints of moist desquamation or tumor control respectively. The significance of the order of application of the two modalities was, however, different in the two systems. In mouse skin, the order of application was significant only when heat was applied prior to irradiation under ambient conditions. In this protocol, the skin was sensitized and responded to irradiation like fully oxygenated mouse skin. Heat administered under hypoxic conditions had the same effect on mouse skin as heat administered under ambient conditions when combined with irradiation under hypoxic conditions. In the tumor system, the order of application of heat and radiation was significant for each condition of tissue oxygenation with heat being more effective when given after irradiation. A very high equivalent rad effect of the heat was observed when given following irradiation under hyperbaric O_2 conditions. This was taken to indicate an extreme sensitivity of the chronically hypoxic tumor cells to radiation and heat. The decreased effectiveness of the heat when given prior to irradiation was explained on the basis of a hypoxic state developing in the tumor following heating. This is in contrast to the skin data. It appeared that the skin cells and the tumor cells had the same inherent heat sensitivity and that differences in the heat effect depended upon the order of application of the two modalities and the oxygen status of the tissue. The most therapeutically beneficial protocol, in terms of maximal tumor damage and minimal skin damage, was radiation under hyperbaric O_2 conditions followed by heat. Small radiation doses in this protocol could produce as much as 80 times greater survival reduction in the tumor than in skin. The exact mechanism of interaction between the two modalities could not be determined. Heat damage was completely repaired in the first 12 hours following administration of the heat. Heat damage was linearly related to the length of the heat treatment in the range of 0-30 minute treatment times. (Diss. Abstr. Int., B)

32534 BACTERIAL LIPOPOLYSACCHARIDES AND THEIR STRUCTURAL COMPONENTS AS RADIOPROTECTIVE SUBSTANCES. Langendorff, H.; Langendorff, M.; Weckesser, J.; Steinbach, K. H. (Univ., Freiburg i. B.). Acta Radiol., Suppl.; No. 310, 173-180(1971). (In German).

An increase of radiation resistance was observed in mice that 24 hours before irradiation in the dose range 640 to 955 R received lipopolysaccharides (LPS, endotoxin) of Salmonella minnesota, Escherichia coli or Rhps capsulata. The dose reduction factors (DRF) obtained were: 1.193 for the LPS of S minnesota, 1.218 for the LPS of E coli and 1.092 for the LPS of Rhps capsulata. The LPS of Rhps capsulata (family: Athiorhodaceae) proved to be significantly less effective than the LPS of S minnesota or E coli (both belonging to the family of the Enterobacteriacese). As known in the case of LPS of E coli the sex of the animals had no influence on the extent of the radioprotective effect. Regarding the ability to reduce radiation mortality caused by the individual structure components of the different LPS, it was observed that the polysaccharide part in no case had any effectiveness in radiation protection experiments. Neither the O-specific chains nor the isolated core of the LPS of S minnesota reduced the radiation sensitivity of the animals; the polysachharide part (degraded polysaccharide) of the LPS of E coli and Rhps capsulata had a corresponding effectiveness. In contrast, both the glycolipid lipid-A-$(KDO)_2$ of S minnesota R_{595} and the lipid-A preparations of E coli and Rhps capsulata had a high effect on increasing the radiation resistance, comparable to that of the corresponding LPS. The experiments proved that the lipid-A (also responsible for the endotoxic characteristics of LPS) represents the effective structure component of the applied LPS in radiation protection experiments. The mechanism of the radioprotective effect of bacterial endotoxin is discussed in connection with the cAMP-mechanism. It is assumed that the LPS does not directly act on the cell, but that its action is mediated by hormones, such as catecholamines, which on their part activate the membrane-bound adenylcylase system of an effector cell, leading to an increase in the 3'5'-AMP concentration in the cell. This assumption was confirmed by experiments carried out with the β-adrenergic blocking agent LB 46, which prevented the radioprotective effect of the LPS if it was administered 15 min before the application of LPS. (auth)

32535 PROTECTIVE EFFECT OF CYSTEAMINE AGAINST FRACTIONATED IRRADIATION. III. Histopathologic Diagnoses

at Death. Nelson, A.; Jaerplid, B.; Nilsson, A.; Roennbaeck, C.; Eriksson, K. H. (Foersvarets Forskningsanstalt, Stockholm). Acta Radiol., Suppl.; No. 310, 181-199(1971).

Groups of mice were exposed to repeated doses of 80 R and 160 R at various time intervals with a view to studying the protective effect of cysteamine against late effects from sublethal doses of irradiation. The accumulated doses were selected to fall definitely in the range between sublethal and supralethal doses. Half the number of animals in each group were given cysteamine before each irradiation. The histopathologic diagnosis at death were investigated among those surviving the acute effects, i.e., 30 days after last irradiation. It was concluded that cysteamine had a protective effect only against radiation induced unclassified leukemias. The effect on other specific late effects was equivocal. (auth)

32536 EFFECT OF ANEMIA ON THE CELLULAR KINETICS OF ERYTHROCYTE PRECURSORS IN THE BONE MARROW OF THE X-IRRADIATED, THE X-IRRADIATED-BLED, AND THE NONIRRADIATED RAT. Braunschweiger, P. G. III. Buffalo, NY; State Univ. Of New York (1974). 961p. University Microfilms Order No. 74-19,961.

Thesis (Ph. D.).

The erythropoietic response to anemia was studied in the bone marrow of non-irradiated, x-irradiated and x-irradiated-bled rats, 9 weeks after irradiation (50 R). Rats were rendered anemic by acute removal of 50% of the calculated blood volume by venesection via the jugular vein, and studied 44, 60, and 72 hours later. Utilizing ^{3}H-thymidine and ^{14}C-thymidine (injected within several hours prior to sacrifice) in a double labelling technique and employing double emulsion autoradiography, the cellular and population kinetics of the early, late, intermediate and orthochromatic normoblasts were studied. Cell cycle times, DNA synthesis times, mitotic times, pre-mitotic and post-mitotic intervals, as well as cellular differentiation rates, compartmental transit times and mitotic and labelling indices were determined. Cell cycle times were shortened (from approximately 12 hours to 8 hours), the total number of erythroid divisions increased (from 5.9 to 6.5 divisisons), and the total transit time shortened (73 hours to 59 hours) for erythrocyte precursors in anemic, non-irradiated rats. In anemic x-irradiated rats, the cell cycle times were not shortened, and both the number of erythroid divisions and the rate of stem cell differentiation were subnormal. In the x-irradiated-bled rats a reduction in erythrocyte precursor cell cycle duration and total transit time was observed only after 72 hours of anemic stimulation. In all cases, the shortening of the cell cycle time was a reflection of a diminished G1 interval. Under non-anemic conditions, the erythroid precursors in all animals (regardless of treatment) showed similar cellular kinetics. These findings suggest that subnormal proliferation of recognizable erythroid precursors during anemic stress is primarily due to fewer stem cells differentiating into the erythroid line, fewer erythroid mitotic divisions in the maturing and dividing compartment, and longer compartmental transit times for individual maturation stages. The overall findings are consistent with the hypothesis that a compartment of stem cells, committed to erythroid and myeloid differentiation (CPC) acts as a "buffer" between the pluripotential stem cell compartment and the morphologically recognizable precursors. The results are discussed in terms of a modification of the Kretchmar model for the action of regulatory hormones on hematopoietic stem cells. In this model the differentiation of committed stem cells by erythropoietin or myelopoietin, is dependent on the length of the G1 phase of the cells in the committed precursor cell compartment. (Diss. Abstr. Int., B)

32537 ENZYME ACTIVITY OF DECARBOXYLASE FOR AROMATIC AMINO ACIDS, OF KYNURENINASE, AND OF AMINOTRANSFERASE IN LIVER TISSUE OF IRRADIATED RATS. Streffer, C.; Ababio, B. M. (Univ., Frieburg i. B.). Acta Radiol., Suppl.; No. 310, 210-220(1971). (In German).

The activity of the decarboxylase for aromatic amino acids was found to be decreased in the liver of female rats after whole body irradiation. The DOPA decarboxylase activity was significantly decreased from the second day after irradiation with 1000 R. The same result was obtained for the enzymatic decarboxylation of 5-hydroxytryptophan. The hepatic activity of the kynureninase was also reduced after whole body irradiations with 1000 R. On the other hand the activity of kynurenine aminotransferase and the ratio of the kynurenine aminotransferase: kynureninase were increased. From the investigation of the time- and dose-dependence for the enzymatic changes a relation followed between the decreased enzyme activities and the mortality of the rats. The observed radiation induced enzymatic changes were found to a similar extent in vitamin B_6 deficiency. The decrease of the enzyme activities was not caused by a lack of pyridoxal-5'-phosphate in the radiation syndrome, however. It is suggested that the biosynthesis of the enzyme proteins is disturbed by the ionizing radiation. (auth)

32538 SPLEEN DNA DAMAGE FOLLOWING X IRRADIATION IN THE PRESENCE OF CHEMICAL RADIOPROTECTORS. Suciu, D.; Uray, Z.; Banu, C. (Oncological Inst., Cluj). Stud. Biophys.; 42: No. 2, 105-110(1974).

The administration of radioprotective agents (AET, Luvatren, imipramine or sulphamethazine) has no influence on the early elimination of spleen deoxyribopolynucleotides after irradiation with 300 R. The spleen DNA fragmentation 24 hours after irradiation with 1000 R is also unprotected by administration of chemical radioprotectors. (auth)

32539 ACRIDONE COMPOUNDS AS POTENTIAL ANTIRADIATION AGENTS. Postescu, D.; Mustea, I. (Oncological Inst., Cluj). Stud. Biophys.; 43: No. 3, 233-236(1974).

The radioprotective properties of a series of new synthetized N-substituted acridone derivatives in mice irradiated with a dose of 500 R were demonstrated. The effect depends on the delay between drug administration and irradiation. If irradiation was performed with the lethal dose of 750 R the effect was less expressed. (auth)

32540 RADIATION PROTECTION OF THE NORMAL KIDNEY BY SELECTIVE ARTERIAL INFUSIONS. Steckel, R. J.; Collins, J. D.; Snow, H. D.; Lagasse, L. D.; Barenfus, M.; Anderson, D. P.; Weisenburger, T.; Hauskins, L. A.; Ross, N. A. (Univ. of California, Los Angeles). Cancer; 34: No. 4, 1046-1058(Oct 1974).

Successful unilateral renal radioprotection was attained in 10 of 18 experimental animals receiving protracted and fractionated radiation to large abdominal fields and unilateral renal artery epinephrine infusions, including 6 of the last 7 animals so treated. In a pilot series of patients with Stage III ovarian malignancies who were treated in a similar manner with unilateral renal artery epinephrine infusions, successful unilateral renal radioprotection was also achieved in 3 out of 5 evaluable patients (the other 2 patients received potentially nephritic radiation doses to both kidneys, but have not in fact developed radiation nephritis on either side). In a series of 10 experimental animals, production of temporary unilateral renal hypoxia during abdominal irradiation by the use of a balloon occlusion catheter did not prove reliable in effecting unilateral renal radioprotection. However, in a subgroup of 5 animals, the data suggest that simultaneous infusion of a vasoconstrictor combination into the superior mesenteric artery during irradiation may prevent morbidity and mortality from acute radiation enteritis, under the experimental conditions employed. (auth)

32541 UPTAKE AND DEGRADATION OF PARTIALLY DENATURED PROTEINS BY DIFFERENT ORGANS FROM FED, STARVED, AND STARVED IRRADIATED RATS. Gerber, G. B.; Remy-Defraigne, J.; Lambiet-Collier, M. (CEN/SCK, Mol, Belgium). Acta Radiol., Suppl.; No. 310, 147-162(1971).

Partially denatured ^{125}I albumin was injected into starved, starved roentgen irradiated (24 h after 850 R) and fed rats and its fate was followed in different organs and in subcellular fractions of liver, small intestine and spleen. Uptake and subsequent release is most rapid in liver and kidney, but due to their great share in body mass, muscle and skin also contribute markedly to the degradation of albumin. Activity in the intestine is low and in part derived from material excreted by the bile. Irradiated animals exhibit higher activities in the stomach and intestinal contents and lower activities in the spleen but no indication is found to support the theory of an increased in vivo proteolytic activity in irradiated animals. (auth)

32542 IRRADIATION EFFECT ON THE SUPRARENAL GLAND. VIII. Reduction of Corticosteroid Antigen Through Cysteamine, Serotonine, and Pyrexal After X Irradiation. Geierhaas, B.; Flemming, K. (Univ., Freiburg i. B.). Acta Radiol., Suppl.; No. 310, 137-146(1971). (In German).

In testing the effect of radioprotective drugs on the biphasic corticosteroid increase after whole-body roentgen irradiation, the following results were obtained: Cysteamine, serotinin, and Pyrexal, a lipopolysaccharide from S. abortus equi, reduced both the first and the second corticosteroid increase which occurs following 750 and 1000 R. Cysteamine was more effective than serotinin. Pyrexal reduced the first increase after 750 R and 1000 R; the second increase, however, was inhibited only after 750 R. The inhibiting effect of the drugs was the same on the mortality as well as the second corticosteroid increase. It is concluded from these results that the reduction of the second corticosteroid increase is a radioprotective effect. As far as the first corticosteroid increase is concerned, the radioprotective effect of the drugs is believed to be only a partial component

of the inhibition. The stimulating effects of the drugs on the adrenal cortex lasted until the time of the corticosteroid determination. Therefore, feed-back effects in the pituitary adrenocortical system might contribute to the inhibition of the first increase. (auth)

32543 REPAIR AND REPOPULATION IN MOUSE SKIN DURING FRACTIONATED NEUTRON AND X-IRRADIATION. Denekamp, J.; Field, S. B. (Mount Vernon Hospital, Northwood, Eng.). Eur. J. Cancer; 10: No. 4, 241-247(Apr 1974).

From second meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; The Hague, Netherlands (3 Oct 1973).

The relative importance of repair and repopulation after single large doses and after multiple small doses has been investigated both for x-rays and neutrons, using a new experimental design. A considerable dose increment was necessary within 24 hr after 1000 rad of x-rays or 450 rad of neutrons; no dose increment was necessary in the following 8 days, but by 15 days 400 rad were necessary in both cases to counteract repopulation. During multifraction irradiation (with 4, 9 or 14 fractions of 100 rad of neutrons or 300 rad of x-rays) considerable dose sparing was observed. However, 24 hr after the last fraction of x-rays, a large dose increment was necessary, but after neutrons the skin was more sensitive (i.e. a negative increment); this is presumed to be a result of synchrony. The repopulation rate increased with increasing number of fractions with x-rays. After 4 and 9 fractions of neutrons a similar result was obtained. But after 14 fractions of neutrons it appeared that the repopulation in 8 days was much smaller than after x-rays. RBE values of 2.2 at 1000 rad of x-rays single dose and 3.0 at 300 rad of x-rays per fraction were confirmed. (auth)

32544 RADIATION EFFECTS AND ADRENAL CORTEX. VII. Corticosteroid Changes in Mice Following Whole-Body Irradiation. Flemming, K.; Hellwig, J. (Univ., Freiburg i. B.). Acta Radiol., Suppl.; No. 310, 124-136(1971).

The corticosteroid content in the adrenals and in the peripheral blood was determined in mice after whole-body irradiation. The role of certain non-specific factors was also considered. The following results were obtained. The corticosteroid content showed a diurnal rhythm with a minimum at 0 hr and a maximum between 16 and 20 hrs. Sham irradiation could also produce a corticosteroid increase due to stress reactions caused by individual housing and overcrowding. This non-specific stress effect was eliminated by habituation of the experimental animals. Following partially lethal and absolutely lethal radiation doses, an increase of the corticosteroid content in the adrenals and in the blood was found. The first corticosteroid increase had a maximum immediately after irradiation and lasted for one or two hours. A second corticosteroid increase occurred after 24 hours. It was reversible after partially lethal doses and irreversible after absolutely lethal doses. About 12 hours preceding death, a terminal corticosteroid increase occurred as well. The investigation of the dose dependence showed an increase of the corticosteroid values with increasing radiation doses in the range between 0 and 1250 R and the range between 10,000 and 30,000 R. The corticosteroid level remained constant, however, after doses between 1250 and 10,000 R. (auth)

32545 DNA-SYNTHESIS IN THE SPLEEN OF MICE AFTER WHOLE-BODY X-IRRADIATION AND ITS MODIFICATION BY 5-HYDROXYTRYPTAMINE AND NADH. Streffer, C. (Univ., Freiburg i.B.). Int. J. Radiat. Biol.; 25: No. 5, 425-435(May 1974).

The rate of ^{3}H-thymidine incorporation into DNA and the DNA content were measured in the spleen of mice. After whole-body x-irradiation, DNA synthesis decreased rapidly after radiation doses of 15 to 150 R. When the dose-dependence of DNA synthesis was plotted semilogarithmically three hours after irradiation a straight line resulted; six hours after irradiation a curve with a shoulder and a D_0 of 54 R. It was assumed that this radiosensitive part of the dose-effect curve represented DNA synthesis in medium-sized lymphocytes. The levels of adenine nucleotides were not changed under these conditions. NADH and 5-hydroxytryptamine depressed DNA synthesis in the spleen for a short period. When these substances were injected before irradiation the initial reduction of DNA synthesis was modified but the recovery started earlier. Also the DNA content did not decrease so much under these conditions. (auth)

32546 PROTEIN BIOSYNTHESIS IN THE LIVER OF X-IRRADIATED MICE. Mukerjee, H.; Goldfeder, A. (New York Univ.). Int. J. Radiat. Biol.; 25: No. 5, 445-454(May 1974).

The effects of 600, 1000, 2000, and 4000 rads of whole-body x-irradiation on protein biosynthesis in X/Gf mouse livers were studied at 10 min after each dose, at which time ^{14}C-leucine was injected i.p. No effect on protein biosynthesis was observed below 600 rads. Above 600 rads, protein biosynthesis increased with increasing dose. With 4000 rads protein biosynthesis reached 70 to 75 per cent above the control level. Time-course effects of irradiation on protein biosynthesis were studied at 10, 30, 60, 120, 240, and 480 min after 2000 rads. Protein biosynthesis reached 50 to 55 per cent above control 10 min after 2000 rads and gradually levelled off within 4 hours, reaching control level. Incorporation of ^{14}C-leucine into liver proteins at 1 hour after 2000 rads reached 30 per cent above control at 20 min after the injection of precursor, whereas labelling of ribosomal protein reached 45 per cent above control at 3 min after injection of the label. Enhanced protein biosynthesis after x-irradiation is explained: (a) by increase in ribosomal population, and (b) by increase in concentration of acid-soluble precursors in intracellular pool of x-irradiated livers. (auth)

32547 RBE VALUES OF 15 MeV NEUTRONS APPLIED AT LOW DOSE RATE. Kal, H. B.; Barendsen, G. W.; Broerse, J. J. (Gezondheidsorganisatie TNO, Rijswijk, Netherlands). Eur. J. Cancer; 10: No. 5, 293-296(May 1974).

From second meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

Experiments are described in which responses of a solid rhabdomyosarcoma and skin of the rat were compared after irradiation with 15 MeV neutrons and ^{137}Cs gamma rays applied at low dose rates. The RBE of 15 MeV neutrons for damage to the rhabdomyosarcoma was larger by a factor of 1.6 as compared with the RBE for damage to rat skin. This factor was significantly larger than the corresponding values ranging from 1.1 to 1.3 for high dose rates. The implications of these results are discussed with a view of the application of ^{252}Cf neutrons in interstitial and intracavitary radiotherapy. (auth)

32548 COMPARISON OF RBE VALUES OF 15 MeV NEUTRONS FOR DAMAGE TO AN EXPERIMENTAL TUMOR AND SOME NORMAL TISSUES. Phillips, T. L. (Univ. of California, San Francisco); Fu, K.; Rowe, J.; Barschall, H. H.; Goldberg, E. Eur. J. Cancer; 10: No. 5, 287-292(May 1974).

From second meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

A 15 MeV deuterium-tritium neutron generator yielding between 1×10^{12} and 3×10^{12} neutrons per sec was used to measure damage in the EMT6 tumor, bone marrow, oesophagus, and lung of the mouse. RBE and OER values for the tumor were relatively close to those previously reported for the R-1 rhabdomyosarcoma in the rat, the RBE ranging from 6.3 at 50% survival of hypoxic cells downward as a function of dose and the OER for neutrons being 1.8. The RBE's for bone marrow CFU's, oesophageal lethality, and pulmonary lethality were 1.6, 4, and 2.2, respectively. These results confirmed the relative consistency of rodent tumors in response to neutrons and added further evidence of the wide range of RBE's to be expected in normal tissues. (auth)

32549 EFFECT OF FRACTIONATED DOSES OF NEUTRONS ON C_3H MOUSE MAMMARY TUMORS. Fowler, J. F.; Denekamp, J. (Mount Vernon Hospital, Northwood, Eng.). Eur. J. Cancer; 10: No. 5, 281-285(May 1974).

From second meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

The doses required to control 50% of tumors at 150 days after irradiation had previously been determined for three neutron and three x-ray fractionation schedules: single doses, 5 fractions in 9 days (5F/9d) and 9F/18d. The present experiments extended this work to 3F/4d and 15F/18d neutron and x-ray fractionation schedules. The tumor control results were compared with skin reactions caused in the feet of albino mice by the same dose schedules. Little difference in therapeutic effectiveness was found between the neutron and x-ray results, both the neutron and x-ray 3F/4d schedules being good and both 15F/18d schedules being poor. (auth)

Invertebrates

Refer also to abstract 32381.

32550 (NYO-3093-1-5) INVESTIGATION ON RADIATION STERILIZATION FOR THE CONTROL OF THE SOUTH AMERICAN FRUIT FLY ANASTREPHA FRATERCULUS (WIED.). Progress Report, January–December 1972. Gonzalez Bachini, J. E.; Pantigoso, B. J. (Estacion Experimental Agricola de la Molina,

Lima (Peru)). May 1973. Contract AT(11-1)-3093. 11p. (In Spanish). Dep. NTIS $4.00.

Advances in research on the seasonal evaluation of native populations of Anastrepha fraterculus and Ceratitis capitata in the Chillon valley are reported. The highest captures of both species were registered during April and May, in the region corresponding to Maleza Desertica sub-tropical (sub-tropical Pow weed desert vegetation region). The mango, chirimoyo and guava trees have been observed to be the main hosts of A. fraterculus, and peach, pear and coffee for C. capitata. Other hosts for A. fraterculus were: Palillo, nut and an unidentified Passifloraceae. 25,000 mangoes artificially infested with A. fraterculus and treated with liquid Ethylene Dibromide (18 gr/m^3) caused 100% mortality of immature stages. Methods for releases of adults of A. fraterculus using paper bags, liberating cages and on the floor were assayed. The cage system gave better results: 58.1% of capture with an emergence between 65.5% and 84.5%. Studies on dispersion limits of A. fraterculus and C. capitata gave captures of adults at 1,620 mts above sea level and immature stages for both species were located at 1550 mts above sea level. In mass rearing was observed 70 to 90% of eggs viability. The cages were artificially provided with indirect light and humidity by means of sponges applied on the inner walls of the cages. (auth)

32551 (NYO-3093-1-8) INVESTIGATION ON RADIATION STERILIZATION FOR THE CONTROL OF THE SOUTH AMERICAN FRUIT FLY ANASTREPHA FRATERCULUS (WIED.). Progress Report, January–December 1973. Gonzalez Bachini, J. E.; Pantigoso, B. J.; Vargas Vargas, C. A. (Estacion Experimental Agricola de la Molina, Lima (Peru)). May 1974. Contract AT (11-1)-3093. 6p. (In Spanish). Dep. NTIS $4.00.

Research on the influence of soil humidity in the penetration of A. fraterculus larvae to pupate is reported. Sandy loam soil was used in this research and as treatments: wilting point, field capacity and saturation capacity. Results indicate no significant differences among the treatments. In studies on gamma sterilization doses for cooled adults of A. fraterculus, performed in a kitchen refrigerator, adults A. fraterculus were immobilized for 10 to 15 minutes under 10°C during 15 minutes. Experiments to evaluate capture efficiency of the McPhail traps baited with hydrolyzed protein indicated different indexes of capture with seasons of the year. In the Chillon valley conditions the average capture was 6.2 adults of A. fraterculus for each 100 released flies. Preliminary tests of interspecific competition between A. fraterculus and C. capitata at egg and larvae stage fed in the same artificial diet indicated that C. capitata increases its recuperation percentage egg/pupae and A. fraterculus decreases the same percentage. Finally the development of mass rearing of A. fraterculus during 1973 is reported; 80% of the production was liberated for research and the other 20% for laboratory rearing and tests. (auth)

32552 ANALYSIS OF THE CHROMOSOME ABERRATIONS INDUCED BY X-RAYS IN SOMATIC CELLS OF DROSOPHILA MELANOGASTER. Gatti, M.; Tanzarella, C.; Olivieri, G. (Univ., Rome). Genetics; 77: No. 4, 701-719(Aug 1974).

A technique has been perfected for enabling good microscope preparations to be obtained from the larval ganglia of Drosophila melanogaster. This system was then tested with x rays and an extensive series of data was obtained on the chromosome aberrations induced in the various stages of the cell cycle. The analysis of the results obtained offers the following points of interest: (1) There exists a difference in radiosensitivity between the two sexes. The females constantly display a greater frequency of both chromosome and chromatid aberrations. They also display a greater frequency of spontaneous aberrations. (2) In both sexes the overall chromosome damage is greater in cells irradiated in stages G_2 and G_1. These two peaks of greater radiosensitivity are produced by a high frequency of terminal deletions and chromatid exchanges and by a high frequency of dicentrics, respectively. (3) The aberrations are not distributed at random among the various chromosomes. On the average, the Y chromosome is found to be more resistant and the breaks are preferentially localized in the pericentromeric heterochromatin of the X chromosome and of the autosomes. (4) Somatic pairing influences the frequency and type of the chromosome aberrations induced. In this system, such an arrangement of the chromosomes results in a high frequency of exchanges and dicentrics between homologous chromosomes and a low frequency of scorable translocations. Moreover, somatic pairing, probably by preventing the formation of looped regions in the interphase chromosomes, results in the almost total absence of intrachanges at both chromosome and chromatid level. (auth)

32553 REPAIR REPLICATION AND PHOTOREPAIR OF DNA IN LARVAE OF DROSOPHILA MELANOGASTER. Boyd, J. B.; Presley, J. M. (Univ. of California, Davis). Genetics; 77: No. 4, 687-700(Aug 1974).

Repair replication of DNA was studied in first instar larvae of Drosophila melanogaster with isopycnic centrifugation techniques. Larvae were fed BUdR, FUdR, streptomycin, penicillin, and Fungazone for two to four hours prior to exposure to uv, x rays, MMS, or EMS. Feeding was continued for four hours in the presence of ^{3}HBUdR and DNA was isolated from whole larvae. Repair replication is stimulated by each of these agents. MMS is about 10 times as potent as EMS in stimulating repair synthesis. A dose of 200 ergs/mm^2 largely saturates the level of repair replication observed after uv irradiation. Repair replication rises betwen 0 and 80,000 R of x rays before falling off. Semiconservative synthesis is seriously inhibited above a dose of 40,000 R of x rays. Photorepair has been detected as a reduction in repair synthesis resulting from post-irradiation exposure to photoreactivating light. The same treatment has no detectable effect on x-ray-stimulated repair replication. Repair replication is insensitive to the presence of caffeine or hydroxyurea during the final incubation, although semiconservative synthesis is strongly inhibited by these agents. A mixture of BUdR and ^{3}HTdR can be used to replace ^{3}HBUdR in detecting repair replication. (auth)

32554 INVESTIGATION ON RADIOSENSITIVE AND RADIORESISTANT POPULATIONS OF DROSOPHILA MELANOGASTER. VI. Selection for Further Increase in Relative Radioresistance of Stage-7 Oocytes of the Irradiated Population ROE I. Noethel, H. (Freie Univ., Berlin). Mutat. Res.; 25: No. 1, 135-139(Oct 1974).

The data support the following conclusions: (I) After 10 generations of radiation exposure at a rate of 4000 R per generation, $R\ddot{O}\ I_4$ exhibits about the same sensitivity as $R\ddot{O}$ I. (2) After 44 to 59 generations, $R\ddot{O}$ I has become adapted to the higher exposure level by evolving a higher relative radioresistance with respect to both end-points of radiation damage measured, this increase being highly significant. (3) No further increase in relative resistance could be observed up to generations 71 to 84. (auth)

32555 EFFECTS OF RADIATION EXPOSURE-RATE AND EXPOSURE FRACTIONATION ON THE FREQUENCIES OF RECESSIVE AND DOMINANT LETHALS IN IMMATURE OOCYTES OF DROSOPHILA MELANOGASTER. Sankaranarayanan, K. (State Univ., Leiden). Mutat. Res.; 25: No. 1, 39-51(Oct 1974).

The effects of administering x irradiation at high versus low exposure-rates and as single versus fractionated exposures (total exposure split into two equal fractions separated by various time intervals) on genetic damage induced in immature oocytes of Drosophila were investigated. The results show that in stage 7 oocytes, the frequencies of recessive lethals are the same irrespective of the mode of irradiation; in stages immediately preceding stage 7, there is some suggestive evidence for a lowering of the frequencies at low exposure rates. The frequencies of dominant lethals induced in stage 7 oocytes are markedly reduced after low intensity radiation as well as after fractionation of the exposure; while with the former regime the frequencies continue to decrease up to 60 min (the longest duration employed), with the latter regime the maximal reduction in frequency is obtained when the interval between the exposure fractions is 10 to 20 min. Increasing the interval to more than 20 min does not lead to any further measurable reduction in the frequency. (auth)

32556 DOSE PROTRACTION AND INDUCED COMPOUND AUTOSOME NON-DISJUNCTION IN X-IRRADIATED IMMATURE OOCYTES OF DROSOPHILA MELANOGASTER. Leigh, B. (Univ., Leiden). Mutat. Res.; 25: No. 1, 141-142(Oct 1974).

The effects of dose protraction are reported here. For acute exposure a dose rate of 2800 R per min was used and the comparative protracted exposures were given at 10 R per min. An ENRAF x-ray machine was used for all treatments. For each set of irradiations, young virgin C(2L),j; C(2R),px females were collected and split into three groups. The first group were given an exposure at high dose rate (Acute I), the second group a protracted exposure (Protracted), and the third group were then given a high dose rate exposure (Acute 2). After irradiation the females were mass mated to C(2L),bpr; C(2R),vg males. They were kept in vials for 2 days (brood A), then in bottles for 1 day (brood B), and subsequently fresh bottles for a further 2 days (brood C). Five sets of irradiations were given using an exposure of 1000 R and three sets using an exposure of 1500 R. No significant differences were found between the repeats at each dose level. There were no significant dose rate effects in any of the three broods at either dose level. This is interesting because Sobels found a fractionation effect, although only at 3000 R and not at lower doses. Technically, it would be very difficult to give such a dose at 10 R per min. C(2) non disjunction, like X chromosome non-disjunction, is often accompanied by abnormal segregation of other chromosomes. This indicates that similar multi-hit mechanisms may be involved and a dose-protraction effect would be expected. Clark and Sobels found a linear dose-frequency relationship for the induction of disomics in their first brood. This,

however, covered the first three days of egg laying. There is significant heterogeneity within this period. In brood A, days 1 and 2, the frequencies of disomics recovered after an exposure of 1000 R are significantly higher than after 1500 R ($P < 0.05$). In brood B, day 3, the higher dose induces higher frequencies ($P < 0.01$). The mechanism, which causes the inverse dose relationship in brood A, is not clear. The observation, however, provides an indication that the linearity reported by Clark and Sobels probably has a complex origin and does not simply reflect I-hit kinetics. In brood B and C there is an apparent tendency for the frequencies of disomics to be higher after Acute 2 than after Acute I. This indication of a sensitivity change in a relatively short period of time was not found in later experiments. (auth)

32557 GAMMA IRRADIATION OF THE FACE FLY, MUSCA AUTUMNALIS DEGEER (DIPTERA: MUSCIDAE). Gregory, D. J. Ontario; Univ. of Guelph (1974). vpp. National Library of Canada, Ottawa.

Thesis (Ph. D.).

Pupae of the face fly, Musca autumnalis DeGeer, were irradiated at 5 days of age using gamma radiation from a ^{60}Co source. Experiments were conducted to determine the effect of radiation dose on the fertility and longevity of the resulting adults. An irradiation dose of 2.5 krad induced permanent sterility in both males and females without affecting their longevity significantly. A similar result was obtained with males from a colony of field-collected flies reared through eight generations. Pupae irradiated under anoxic conditions required twice the radiation dose to achieve the same degree of sterility. Competitive and mating tests indicated that males irradiated at 2.5 krad were as competitive as normal males. The mating tests indicated that untreated males inseminated a mean of 4.44 females, whereas males irradiated at 2.5 krad and 5.0 krad, inseminated a mean of 4.28 and 3.44 females respectively. Males irradiated with 5.0 krad in anoxia inseminated a mean of 4.02 females. Competitive tests using ratios of irradiated males : normal males : normal females indicated that males irradiated at 2.5 krad were as competitive as normal males at the ratios 1 : 1 : 1, 2 : 1 : 1, 5 : 1 : 1, and 1 : 2 : 1 in small cages, but less competitive at the 5 : 1 : 1 ratio in large cages. Males irradiated at 5.0 krad in air were less competitive than the normals at all ratios tested, whereas males irradiated at 5.0 krad under anoxic conditions were as competitive as normal males at all ratios tested. A colony of flies was infected with the nematode parasite, Heterotylenchus autumnalis Nickle. Irradiation of parasitized, 5-day-old pupae, indicated that the parasite was not adversely affected by radiation doses of 1.0 and 2.5 krad. The results indicated some promise in the potential use of the sterile male in an integrated control program against the face fly. (Diss. Abstr. Int., B)

Radionuclide Effects (Internal Source)

Man

Refer also to abstracts 32001, 32035, 32037, 32446, 32447, 32474, 34463, and 34495.

32558 (AEC-tr-7571, pp 144-151) MICRODISTRIBUTION OF THE ABSORBED ENERGY FROM ALPHA-EMITTING ISOTOPES INCORPORATED INTO THE LUNGS. Communication 1. Insoluble Compounds. Belonogii, P. N.; Ivanov, V. N.; Makeeva, L. G.; Pavlovskaya, N. A. (Moscow Physical Engineering Inst.). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 271-276 (1974).

A method of approximate calculation of the distribution of the density of locally absorbed energy from α-emitting isotopes, incorporated into the lungs in the form of insoluble compounds, is discussed. The microdosimetric functions $p_1(\Delta Z)$, calculated for a ^{232}Th source at equilibrium with its decay products within the star region are presented. The calculation was performed for one disintegration of a spherical sensitive volume 1 and 10 μ in diameter. (tr-auth)

32559 (CONF-740930-2) CHROMOSOME BREAKAGE IN LYMPHOCYTES FROM HUMANS WITH BODY BURDENS OF ^{226}Ra. Hoegerman, S. F.; Cummins, H. T.; Bronec, J. F. (Argonne National Lab., Ill. (USA)). 1974. 26p. Dep. NTIS $4.50.

From 14th Hanford biology symposium on radiation and the lymphatic system; Richland, Washington, USA (30 Sep 1974).

Peripheral lymphocytes from 10 controls and 40 patients with body burdens of ^{226}Ra ranging from below the limit of detection to 8.6 μCi were scored for unstable chromosome aberrations. The patient population was divided into four groups: those with body burdens below the limit of detection (<0.003 μCi, 12 patients), a low-burden group (0.003 to 0.099 μCi, 13 patients), a moderate-burden group (0.1 to 0.99 μCi, 11 patients), and a high-burden group (>1.0 μCi, 4 patients). The frequency of cells with unstable aberrations observed in all of these groups was not significantly elevated above the level seen in the controls. The rate of occurrence of dicentric and ring chromosomes was above the control frequency in only the two patients with the highest burdens (3.55 and 8.6 μCi). These results are consistent with the expectation derived from a recent calculation of α dose delivered to blood by bone-deposited radium and its decay products. (auth)

32560 (CONF-741018-6) DOSIMETRY OF INTERNAL EMITTERS FOR POPULATION EXPOSURE. Snyder, W. S. (Oak Ridge National Lab., Tenn. (USA)). 24p. Dep. NTIS $4.25.

From 8th midyear topical symposium of the Health Physics Society; Knoxville, Tennessee, USA (21 Oct 1974).

A human population consists of fetuses, infants, children, adults, and the aged, yet the dosimetry of internal emitters for a population is usually based on the dose appropriate for an adult. Whether or not this practice is justified is examined. The dimensions of the body and the masses of the organs vary by an order of magnitude or more with age, and this changes the dose rate per photon by one or two orders of magnitude. The dose rate from electrons and α particles is generally inversely proportional to the mass of the organs, and this also produces differences of an order of magnitude or more in different individuals. Fortunately, intakes of air, fluids, and food are, to some extent, proportional to body mass. However, if contamination is limited to water, milk, or certain foodstuffs, differences of intake with age or with socio-economic groups may be present. Additionally, there are differences in retention of the various radionuclides and their compounds which may greatly influence the total dose received. (auth)

32561 (SSI-1974-011) RADIATION DOSE TO MAN FROM INTRAVENOUSLY ADMINISTERED SODIUM SELENITE LABELLED WITH SELENIUM-75. Falk, R.; Lindhe, J. C. (Statens Strailskyddsinstitut, Stockholm (Sweden)). Feb 1974. 24p. (In Swedish). Dep. NTIS (US Sales Only) $4.25.

The radiation doses received by patients from intravenously administered sodium selenite labeled with ^{75}Se were measured and calculated in patients given the labeled compound for medical diagnosis. The radiation doses to separate body organs were also calculated and the retention of ^{75}Se was studied. Results showed that 12% of the administered amounts was excreted within 24 hours, and 40% of the remaining dose had the biological half life of 20 days and 48% had a biological half life of 115 days. The retention of ^{75}Se in blood has been described with biological half lives of 5 and 97 days respectively. The calculated radiation doses per administered μCi are a little bit higher than earlier calculations. (SW)

32562 RADIATION THERAPY AND PELVIC NODE DISSECTION IN THE MANAGEMENT OF CANCER OF THE PROSTATE. Hilaris, B. S.; Whitmore, W. F.; Batata, M. S.; Grabstald, H. (Memorial Hospital, New York). Amer. J. Roentgenol., Radium Ther. Nucl. Med.; 121: No. 4, 832-838(Aug 1974).

From 55th annual meeting of the American Radium Society; Colorado Springs, CO (22 Apr 1973).

A technique involving a pelvic lymphadenectomy and a retropubic implantation of the prostate with ^{125}I encapsulated sources is described. This technique is simple and applicable to patients with localized cancer of the prostate, clinically stage B or C. It has increased the accuracy of staging, carries no mortality, and has low morbidity. The results have been encouraging with substantial local tumor control and no late urinary or rectal disturbances in the 49 patients who have been followed from 6 to 30 months. (auth)

32563 SYNOVIORTHESIS WITH $^{90}YTTRIUM$. Mueller, W. (Basel Univ. (Switzerland). Rheumatologische Klinik und Poliklinik); Fridrich, R. (Basel Univ. (Switzerland). Nuklearmedizinische Abt.). Deut. Med. Wochenschr.; 99: No. 19, 996-1000 (May 1974). (In German).

3 tabs.; 42 refs.

^{90}Y was injected into 64 joints of 41 patients with chronic rheumatoid arthritis of long-persisting joint effusions related to degenerative joint disease. After intraarticular injection of ^{90}Y in adequate dosage (3 to 6 mCi) complete disappearance of the inflammatory changes occurred in 34, while a partial therapeutic effect was achieved in 22 joints. No change occurred in eight joints. These results and those reported by others indicate that ^{90}Y synoviorthesis now serves as an alternative method to surgical synovectomy, especially in elderly patients. Side effects are slight. But possible late damage can as yet not be assessed so that indications should still be strict. Large joints, especially of the knee, are particularly suitable for ^{90}Y synoviorthesis, while other radioisotopes must be used for smaller joints. (auth)

32564 DAMAGE TO THE LIVER CELLS DUE TO INTRAPERITONEAL RADIOGOLD THERAPY. Simons, F. K. Muenster, Ger.; Muenster Univ. (1973). 67p. (In German). INIS.

Thesis. 18 figs.; 16 refs. With abstract. Available from the library of the Muenster Univ.

Liver changes after intraperitoneal application of radioactive, colloidal gold, were examined. The investigation of early effects took place in animal experiments on mouse livers, which were examined within a time period of ¼ hour to 120 hours. In order to assess the late effects, human biopsy material of 6 patients was available on whom an intraperitoneal radiogold therapy had been carried out for the treatment of cancer of the ovary. The observation time with the biopsy material was extended to a time period of 2 weeks to 8 months. In the animal experiment and in the liver biopsies, the phagocytosis of the gold colloid was microscopically traceable and the morphological behavior of the phagosomes could be reconstructed. Furthermore, it was possible with the help of the x-ray solid-body detector in the electron scan microscope to exactly detect and localize the phagosomes in the Kupffer's cells. Reconstructed from a series of individual findings, a granular degeneration and necrosis develop on the liver parenchyma cells. Small scar fields arise in necrosis regions after a nodular proliferation of Kupffer's cells in the late stages which enclose radiogold-loaded hystiocytes. Liver parenchyma necrosis and the corresponding scar fields were above all observed in the liver lobules. The changes of the liver remain limited and show no prolonged course. Whether these liver damages caused by the radiation of the gold colloid are decisive for the clinical course of the initial illness of the patients depends on which previous damages the liver has undergone prior to treatment. (GE)

32565 RADIATION EXPOSURE TO THE FAMILY OF RADIOACTIVE PATIENTS. Harbert, J. C.; Wills, N. (Georgetown Univ. Hospital, Washington, DC). J. Nucl. Med.; 15: No. 10, 887-888(Oct 1974).

Eleven patients treated with ^{131}I for thyroid carcinoma or thyroid ablation and their immediate family members were monitored by film badge for radiation exposure. The results indicated that the current AEC regulation permitting a patient body burden of 30 mCi at time of hospital discharge is conservative. (auth)

Animals

Refer also to abstracts 32437, 32442, 32477, 32504, 32505, 32511, 32519, 32520, 32594, and 32600.

32566 (AEC-tr-7571, pp 131-137) KINETICS OF EXCHANGE AND BIOLOGICAL ACTION OF AMERICIUM-241 IN DOGS. Moskalev, Yu. I.; Zalikin, G. A.; Lyubimova-Gerasimova, R. M.; Petrovich, I. K.; Rudnitskaya, E. I. (Inst. of Biophysics, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 261-265 (1974).

The influence of toxic doses of americium-241 on dogs was studied. It was established that the basic organs of deposition of the radionuclide are the skeleton, liver, and kidneys. In the acute phase of the lesion, hemorrhagic diathesis is the predominant factor, while in the chronic phase of radiation sickness, the entire symptom complex of somatic effects develops, including leukemia and tumors. (tr-auth)

32567 (AEC-tr-7571, pp 138-143) BIOLOGICAL EFFECTS OF CALIFORNIUM-252. Moskalev, Yu. I.; Zalikin, G. A.; Strel'tsova, V. N.; Semenov, A. I.; Petrovich, I. K.; Zhorova, E. S. (Inst. of Biophysics, Moscow). Aug 1974. Translated from Radiobiologiya; 14: No. 2, 266-270(1974).

The values of the acute, subacute, and chronic effective doses of ^{252}Cf-nitrate in the case of intravenous injection, as well as the doses not influencing the average lifetime of the animals, were established in experiments on white rats. The changes in the morphological composition of the peripheral blood were studied, and the causes of death of the animals and forms of long-term consequences were analyzed. (tr-auth)

32568 (BNWL-1850(Pt.4), pp 85-96) NUCLEAR MEDICINE TECHNOLOGY AND OTHER HEALTH APPLICATIONS. Feb 1974.

In Pacific Northwest Laboratory annual report for 1973 to the USAEC Division of Biomedical and Environmental Research.

A 50-watt intrathoracic $^{238}Pu^{16}O_2$ heat source in a miniature swine produced no clinical signs of untoward effect over a period of almost 10 months, in spite of aortic occlusion and burnup some time prior to sacrifice. An inexpensive portable blood irradiator for clinical use in suppressing circulating lymphocytes and organ graft rejection was developed and is described. A hospital generator for ^{13}N ($T_{\frac{1}{2}}$ = 10 min) suitable for scintiscanning for clinical diagnosis was developed and is described. (CH)

32569 (KFK-tr-445) GENETIC EVALUATION OF A DIET WITH A PREDOMINANCE OF PRODUCTS OF VEGETABLE ORIGIN EXPOSED TO γ RADIATION. Bronnikova, I. A.; Okuneva, L. A. Translated by Rosemarie Corssen from Vop. Pitan.; 31: No. 4, 74-80(1972). 74-80p. (In German). Dep. NTIS (US Sales Only) $4.00.

Since in the earlier works the research was mainly centered on inclusion into the diet of one or a few irradiated products investigation of food rations with the prevalence of irradiated products permitted alimentary consumption both from the scientific and practical viewpoints. Experimental diet for albino rats and mice, in which vegetable products were fully replaced by analogous ones subjected to γ-irradiation was compiled. In the research recorded biochemical, physiological morphological, and other characteristics of the test animals condition were used. The results obtained bear proof to the absence of any marked adverse effect of the experimental diet on the organism of five generations of rats, and they also failed to reveal any mutagenic action of the irradiated vegetable products according to the test for dominant lethals. (auth)

32570 (KFK-tr-446) INVESTIGATION OF POSSIBLE MUTAGENIC EFFECTS OF EXTRACTS FROM IRRADIATED POTATOES AS A FUNCTION OF THEIR STORAGE TIME AND CULINARY PREPARATION. Osipova, I. N. Translated by Rosemarie Corssen from Vop. Pitan.; No. 1, 78-81(1974). 12p. Dep. NTIS (US Sales Only) $4.00.

Mutagenic properties of extracts obtained from raw and cooked potato with the tubers kept for different periods of time after their gamma-irradiation in a dose of 10 krads were investigated. Extracts obtained from potato directly after its irradiation (in 24 hours) were found to exert mutagenic effect on the sexual cells of male mice. Cooking and also storage of irradiated tubers for 40 and 90 days abolished the mutagenic activity of extracts isolated from tubers of experimental potato specimens. (auth)

32571 (UCD-472-121) ANNUAL REPORT, FISCAL YEAR 1974. (California Univ., Davis (USA). Radiobiology Lab.). Jun 1974. Contract AT(04-3)-472. 162p. Dep. NTIS $7.60.

Separate abstracts were prepared for 20 sections of this report. (CH)

For abstracts of individual sections see: 32514–32520, 32572–32580, 32598, 32599, 34540, and 34541.

32572 (UCD-472-121, pp 27-30) SCANNING ELECTRON MICROSCOPY OF BONE PREPARED BY THE CRITICAL POINT DRYING TECHNIQUE. Pool, R. R.; Crisan, B. Jun 1974.

In annual report, fiscal year 1974.

Scanning electron microscopy examinations of areas of active and waning bone resorption and remodeling in samples from beagle pups show transitional cell types, thought to be pre-osteoblasts, supporting the theory of remodeling in discrete sites. This new finding holds exciting portent in the study of ^{226}Ra-induced tumors of bone. (auth)

32573 (UCD-472-121, pp 31-35) MACRODOSIMETRY AND METABOLISM OF ^{226}Ra IN FRACTIONALLY EXPOSED BEAGLE DOGS. Parks, N. J.; Momeni, M. H.; Abrahams, C. D. Jun 1974.

In annual report, fiscal year 1974.

The fractional exposure of 250 beagles to ^{226}Ra in 8 semi-monthly injections at five different levels represents various multiples of the maximum permissible human body burden. Exposures were at the canine age equivalent to young human adulthood. Cumulative rad doses were computed from periodic body burden measurements presently extending to nine years. By direct measurement of radioactivity elimination rates, 8-yr-old dogs initially given ~1 μCi/kg had a calculated long-term half period for bone turnover of 15 to 17 yr. Skeletal ^{226}Ra distributions in these older animals show relatively uniform specific activity in individual bones comparable to the range of the human data. Bone tumor distribution was found to be distinctly asymmetric with respect to radioactivity distribution. (auth)

32574 (UCD-472-121, pp 60-64) CHARACTERIZATION PROFILE OF A ^{226}Ra-INDUCED OSTEOGENIC SARCOMA. Shifrine, M. Jun 1974.

In annual report, fiscal year 1974.

Eleven osteogenic sarcomas (OS) from dogs at the R20, R30, and R40 levels of ^{226}Ra injection were grown in tissue culture and stored in liquid nitrogen at –320°C. All those karyotyped show a karyogram typical of sarcoma. One of these tumors was studied in detail and is being used in studies of tumor immunology and of viral etiology of radiation-induced osteosarcoma. (auth)

32575 (UCD-472-121, pp 66) RADIOLOGIC, PATHOLOGIC, AND ISOTOPE SCANNING CORRELATION OF SELECTED BONE LESIONS. Williams, R. J. R.; Pool, R. R.; O'Brien, T. Jun 1974.

In annual report, fiscal year 1974.

Technetium-99m phosphonate scanning was done on dogs with ^{226}Ra-induced osteosarcomas for correlation of the radiographic lesions and histopathology of biopsy specimens on four animals, and necropsy material on one animal. The results are tabulated. (CH)

32576 (UCD-472-121, pp 68-70) DISTRIBUTION OF ^{226}Ra AND ^{90}Sr-INDUCED PRIMARY BONE SARCOMAS. Pool, R. R.; Williams, R. J. R. Jun 1974.

In annual report, fiscal year 1974.

Radiation-induced primary bone sarcomas (PBS) are more evenly distributed in the canine skeleton than are spontaneous PBS, and ^{226}Ra-induced tumors show no site predilection while ^{90}Sr-induced tumors have demonstrated a propensity to occur in the distal humerus and the mandible. Almost all radiation-induced PBS are osteosarcomas (^{226}Ra: 102 PBS in 159 dogs initially at risk. ^{90}Sr: 29 PBS in 122 dogs initially at risk; some dogs had multiple tumors). (auth)

32577 (UCD-472-121, pp 71-73) MALIGNANT BRAIN TUMOR IN A BEAGLE INJECTED WITH ^{226}Ra. Chrisp, C. E.; White, R. G. Jun 1974.

In annual report, fiscal year 1974.

A malignant astrocytoma, possibly radiation induced, was found in the cerebrum of an 8-yr-old male beagle at the R10 level of ^{226}Ra administration. The dose to the dog was approximately 200 cumulative skeletal rads. (CH)

32578 (UCD-472-121, pp 74-75) TAPETUM LUCIDUM CHANGES IN ^{226}Ra TREATED BEAGLES. White, R. G. Jun 1974.

In annual report, fiscal year 1974.

Semiannual eye examinations were performed on ^{226}Ra-injected and ^{90}Sr-treated dogs. Significant tapetal changes were seen in ^{226}Ra-injected beagles at the R10 level. A summary of effects during 3 yrs is presented covering dogs 5.0 to 9.5 yr of age at the R10 to R30 levels. Higher levels are not represented because the majority of these dogs were dead before February 1971. No effects were seen in the R00 or R05 level or any of the ^{90}Sr treated dogs. (CH)

32579 (UCD-472-121, pp 80-83) MORBIDITY IN RADIONUCLIDE-TREATED BEAGLES. Chrisp, C. E.; Holbrook, C. H.; White, R. G.; Wilson, F. D.; MacMillan, K. L.; Waterman, D. D.; Rosenblatt, L. S. Jun 1974.

In annual report, fiscal year 1974.

Increased morbidity with a decreased mortality reflected aging of a beagle colony and the lower number of high-level dogs at risk for osteosarcoma following administration of ^{226}Ra or ^{90}Sr. Radionuclide radiation may delay onset of mammary tumors. Successful medicine and surgery have significantly increased the lifespan of several animals. (CH)

32580 (UCD-472-121, pp 84-97) CUMULATIVE MORTALITY IN RADIONUCLIDE-TREATED BEAGLES. Chrisp, C. E.; Pool, R. R.; Goldman, M.; Rosenblatt, L. S.; Schneider, R. Jun 1974.

In annual report, fiscal year 1974.

Survival of beagles at the three highest ^{90}Sr dose levels appears dose-related; the first osteosarcoma at the D40 level developed this year. Median lifespan in low dose and control animals will be greater than 12.5 years. (CH)

32581 IMPACT OF PRENATALLY ADMINISTERED RADIOPHOSPHORUS (^{32}P) ON THE POSTNATAL DEVELOPMENT OF SPLEEN AND THYMUS IN SWISS ALBINO MICE. Kumar, A.; Srivastava, P. N. (Rajasthan Univ., Jaipur, India). Arch. Biol. (Liege); 84: No. 3, 443-454(1973).

Ionizing radiations have been shown repeatedly to produce very marked effects on mammalian embryos and fetuses in terms of lethality and production of abnormalities. Radiophosphorus (^{32}P) was intramuscularly injected to pregnant female mice on the third, seventh, eleventh, and nineteenth day of gestation period. The dose rate was 1.0 μCi/g body weight. The spleen and thymus were studied for the histopathological changes at 0 day, 3 days, and 42 days after parturition. There was more or less complete resorption of embryos in the females injected on third and seventh day of gestation. The changes in the spleen and thymus were more pronounced in the offspring of females injected on eleventh day of gestation. (auth)

32582 EFFECT OF DIFFERENT DOSES OF ^{90}Sr ON THE OVARIES OF THE FOETAL MOUSE. Roennbaeck, C.; Henricson, B.; Nilsson, A. (Kungliga Veterinaerhoegskolan, Stockholm). Acta Radiol., Suppl.; No. 310, 200-209(1971).

Groups of female CBA-mice were injected with 5, 10 or 20 μCi of ^{90}Sr on the 11th day of their pregnancy. The effect on the foetal ovaries was examined 56 and 170 days post partum respectively. It was expressed as a reduction in the number of cells in different stages of development, compared to untreated controls. The most sensitive stages were the naked oocytes and the young follicles. The effect was strongly correlated to the administered doses of radiostrontium. Despite the marked reduction in number of oocytes in an early stage of development, the pool of mature follicles was large enough to allow ^{90}Sr-treated female mice to produce litters of normal size and in normal frequency during a limited period. (auth)

32583 EFFECTS OF ^{131}I ON CELLULAR SURVIVAL IN MOUSE THYROIDS. Walinder, G.; Walinder, E. (Forsvarets Forskningsanstalt, Stockholm). Acta Radiol., Suppl.; No. 310, 235-237(1971).

The cellular survival in irradiated thyroid glands in mice was determined by labelling the cells with ^{3}H-thymidine 11 days before injection of ^{131}I. It was possible to show by means of this technique that the observed radioinduced inhibition of the goitrogen-stimulated thyroidal growth was caused by cell death and not merely by a temporary pause in mitosis of otherwise undamaged thyroidal cells. (auth)

32584 RADIOSTRONTIUM-INDUCED EARLY CHANGES IN HAEMATOPOIETIC TISSUES WITH SPECIAL REFERENCE TO THYMUS IN MICE. Jaerplid, B. (Foersvarets Forskningstalt, Stockholm). Acta Radiol., Ther., Phys., Biol.; 12: No. 2, 145-154(1973).

The effects of radiostrontium on the haematopoietic tissues were examined 1 to 50 days after treatment. Special interest was devoted to the thymus, which after treatment regenerated in two phases. (auth)

Nuclide Kinetics and Toxicology

Refer also to abstracts 32092, 32444, and 33016–33019.

Man

Refer also to abstracts 31534 and 32561.

32585 (CONF-741018-1) METABOLIC MODEL FOR WHOLE-BODY AND GI TRACT RETENTION IN A HUMAN INFANT DEDUCED FROM EXPERIMENTAL DATA ON SUCKLING RATS ADMINISTERED A SINGLE ORAL DOSE OF CERIUM-141 AT DIFFERENT AGES. Bernard, S. R. (Oak Ridge National Lab., Tenn. (USA)). 1974. 15p. Dep. NTIS $4.00.

From 8th midyear topical symposium of the Health Physics Society; Knoxville, Tennessee, USA (21 Oct 1974).

Single oral doses of $^{141}Ce(NO_3)_3$ were administered via a stomach tube to nonfasted rats of ages 0, 7, 14, and 25 (weaned) days. Total-body retention in all pups and GI tract retention in the pups dosed at birth were measured. Over an interval of one month, where there was negligible loss of ^{141}Ce from organs in the total-body minus the GI tract and contents, the fractional retention in the total body was approximately given by the complement of a 20-term, cumulative, Poisson function, plus a constant. For calculation of fractional retention in the gut and contents a formula is presented. The model was extrapolated to human infant retention, and dose was estimated for a single intake of 1 μCi of $^{141}Ce(NO_3)_3$, assuming uniform deposition throughout the whole infant GI tract less the contents and assuming complete absorption of energy in the walls. The dose was ~6 rad if ingestion occurred at birth. The retention in the gut wall was taken as constant after 180 days, but the dose due to this retention was about 0.03 rad. The model and the dose estimate and its uncertainties are discussed. (CH)

32586 (KFK-2006) PLUTONIUM-239 CONTAMINATED LACERATED AND INCISED WOUND. Ohlenschlaeger, L.; Schieferdecker, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Medizinische Abt.). Dec 1973. 10p. (In German). INIS.

3 figs.; 3 tabs.; 6 refs. With abstract in English, German and French. Published in Strahlentherapie (1973) v. 146(6) p. 675-684.

Diagnostic and therapeutic measures are reported for a plutonium-239 contaminated lacerated and incised wound on the extensor side of the right wrist joint. The alpha activity measured at the wound was about 200 nCi and could be lowered to 7 nCi by one single excision of the wound lip. Additional decontamination of the wound was provided by wound secretion starting on the fifth day after excision of the wound lip. An intravenous medicamentous therapy carried out in support with Na_3[Ca-DTPA] produced a

marked reduction in the initial deposition in the body. Based on activity analyses performed with urine and fecal samples and using the equations proposed by Langham as well as by Beach and Dolphin, the problem is discussed of an early and ultimate estimate of the body burden, when Na_3[Ca-DTPA] is employed for treatment. (auth)

32587 MATHEMATICAL MODEL OF NATURAL EXCRETION OF RADIOISOTOPES FROM THE ORGANISM. Razumovskii, N. O.; Fokht, A. S.; Lyass, F. M.; Baranovskaya, L. M. Med. Radiol.; 19: No. 10, 68-70(Oct 1974). (In Russian).

On the basis of the analysis of experimental curves, it was established that elimination of radioactive substances from the body is on the whole physically modulated by grade hyperbola and not by an exponent one or the sum of exponents, and biological periods of elimination increase according to geometrical progression. (auth)

32588 CLINICAL INVESTIGATION OF THE BIOLOGICAL HALF-LIFE AND THE RADIOIODINE KINETICS AFTER ORAL ADMINISTRATION OF ^{131}I. Ludwig, P. M. Mannheim, Ger.; Heidelberg Univ. (1972). 91p. (In German). INIS.

Thesis. 16 figs.; 9 tabs.; 102 refs. With abstract. Available from the library of the Heidelberg Univ.

Radioiodine metabolism with 101 patients consisting of 52 euthyroid women, 18 euthyroid men, 21 hyperthyroid and 10 hypothyroid women was investigated. The age distribution of the patients to whom at the beginning 25 to 100 ωCi ^{131}I, according to the size of the thyroid, was orally administered, was from 18 to 69 years. The uptake values dependent on the exogenous iodine application for the 4 groups of patients were examined. A varyingly large ^{131}I uptake was found with men and women and an age regression. The biological half-life for euthyroid men is 41.27 d, for euthyroid women, 33.41 d and for hyperthyroids 6.66 d. The ^{131}I concentration in serum for euthyroid men with physiological accelerating metabolism and ^{131}I uptake and excretion was below those of the euthyroid women. The biological half-life lies between 0.17 d for the hypothyroid and 2.7 d for the hyperthyroid women. After 48 hours, the PBI values were within the standard range. The liver can be considered as transitory storing T_3/T_4 compartment. ^{131}I storing in spleen and bone sacrum is secondarily influenced by the serum iodine level. The assumption that the content of ^{131}I in the inner volume of the myocardium indicates the serum value as well has not been confirmed. The biological half-life values for ^{131}I are 52.8 d in the liver, 17.2 d in the heart region, and 47.5 d for the spleen. The decrease of the PBI curve after 3 weeks coincided with the intensified deiodizing of the kidneys and an increased ^{131}I excretion. After several weeks, not only the vascular cross-section but also the enhanced storage in a few thyroid regions observed in the thyroid scintiscan were peculiar. Investigation with the KI-blocked thyroid confirmed the organ measurments. Low liver values and high spleen and bone sacrum ^{131}I parts were found. The difficulty in the determination of the iodine metabolism is the fact that the parameter resultants investigated are from several steps, in some cases running in contrary directions, which lead to an overlapping of single phases of the iodine cycle. (GE)

32589 AUTORADIOGRAPHY IN DEGENERATIVE DISEASES OF THE HIP-JOINT. Radke, J. (Technische Univ. Muenchen (F. R. Germany). Orthopaedische Klinik und Poliklinik; Gesellschaft fuer Strahlen- und Umweltforschung m. b. H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Biologie). Z. Orthop. Ihre Grenzgeb.; 112: No. 2, 273-282(Apr 1974). (In German)

5 figs.; 10 refs.

The distribution of radiostrontium in the various prearthrotic deformities of the head of femur due to various causes is being analyzed. Not only increased activity as shown in the scintigram but types of ^{85}Sr distribution dependent on the pathology can be identified. Arthrosis of the hip due in the main to mechanical causes shows marginal metabolic zones in weight-bearing areas and those of new bone formation. Arthrosis as seen in Paget's disease, or ulcerating, shows a specific distribution dependent on the cause. When studying autoradiograms the influence of exogenous factors on the course of degenerative metabolic reactions becomes obvious. (auth)

32590 IN VITRO EXPERIMENTS ON THE BINDING OF PLUTONIUM BY POLYAMINOPOLYCARBONIC ACIDS IN THE BLOOD SERUM. Oelschlaeger, F. Karlsruhe, Ger.; Karlsruhe Univ. (1973). 28p. (In German). INIS.

Thesis. 9 figs.; 8 tabs.; 84 refs. With abstract. Available from Karlsruhe Univ. library.

The distribution of $^{239}Pu(NO_3)_4$ between different chelates (Ca-EDTA, Ca-DTPA, Zn-DTPA and Ca-TTHA) and apotransferrin in blood serum was investigated in vitro by electrophoretic separation with regard to the dependence on various parameters: concentration of the chelating agent, incubation time of the reaction compositions and in particular the sequence in which the individual reaction partners (Pu, serum protein and chelating agent) were added to the in-vitro system. Due to the results, an attempt was made to semiquantitatively evaluate the stability of the Pu(IV) complexes with apotransferrin as well as with a few polyaminopolycarbonic acids (DTPA, TTHA). Furthermore it could be deduced that the Pu(IV) chelate of DTPA and TTHA probably have a rigid behaviour, i.e. they are characterized by slow exchange reactions. The mobilization of Pu from its apotransferrin complex by the polyaminopolycarbonic acids proceeds essentially via intermediary ternary complex. A comparison of the chelating effects in vivo with those of the in-vitro results showed on the one hand a certain agreement, so that the in-vitro system investigated appears to be suitable to orientally test general chelating agents and to predict their effectiveness in vivo. On the other hand, there are also few discrepancies of a quantitative nature which render it rather improbable that the in-vivo effectiveness of the chelating agents investigated in solely based on a mobilization of Pu from the apotransferrin complex. (GE)

32591 ^{99m}Tc-POLYPHOSPHATE CONCENTRATION IN A NEUROBLASTOMA. Fizer, P. M. (Riverside Hospital, Newport News, VA). J. Nucl. Med.; 15: No. 10, 904-906(Oct 1974).

A 9-month-old girl showed concentration of the ^{99m}Tc-polyphosphate complex in an adrenal neuroblastoma. There was no uptake in the salivary or thyroid glands. (auth)

32592 COMPARISON OF ^{99m}Tc-POLYPHOSPHATE AND ^{18}F. I. Kinetics. Krishnamurthy, G. T.; Thomas, P. B.; Tubis, M.; Endow, J. S.; Pritchard, J. H.; Blahd, W. H. (Veterans Administration Wadsworth Hospital Center, Los Angeles). J. Nucl. Med.; 15: No. 10, 832-836(Oct 1974).

In 12 patients with suspected bone lesions, the kinetics of intravenoulsy injected ^{99m}Tc-polyphosphate (Tc-PP) were compared with those of ^{18}F. Both radiopharmaceuticals showed biexponential clearance from blood. With both agents, Exponent I clearance half-time is relatively shorter and represents uptake by bone. Exponent II clearance half-time is longer and represents mainly renal clearance. Both Exponent I and II clearances are longer with Tc-PP than with ^{18}F. The relatively slower blood clearance with Tc-PP is due to two major causes. The first is the relatively higher plasma protein binding associated with Tc-PP. About 80% of plasma radioactivity is protein-bound with Tc-PP, and only about 15% with ^{18}F. About 20% of total protein-bound Tc-PP radioactivity is bound to albumin; the remaining 80% is bound mainly to globulin fractions and, to a minor extent, to fibrinogen. Tc-PP protein binding is loose and seems to dissociate easily in vivo. The second major cause of slower Tc-PP blood clearance is red blood cell binding, which is firm and is not washed off completely with normal saline. About 28.2% of the injected dose of Tc-PP is excreted in urine in 4 hr. The genitourinary system is the major nonosseous structure to accumulate injected Tc-PP. (auth)

32593 DIFFERENCES IN CHOROID PLEXUS CONCENTRATION OF PERTECHNETATE PRODUCED BY VARYING TIME OF PERTECHNETATE ADMINISTRATION AND BRAIN IMAGING. Alazraki, N. P.; Littenberg, R. L.; Hurwitz, S.; Quinto, R. R.; Halpern, S. E.; Ashburn, W. L. (Veterans Administration Hospital, San Diego, CA). J. Nucl. Med.; 15: No. 10, 884-886(Oct 1974).

To block effectively the uptake of pertechnetate by the choroid plexus, perchlorate may be given orally at any time before or after the injection of ^{99m}Tc-pertechnetate if administration precedes imaging by at least 60 min. Possible routes of discharge of pertechnetate from the choroid plexuses are back into the blood directly or indirectly through secretion with newly formed CSF. (auth)

Animals

Refer also to abstracts 32095, 32096, 32099, 32105, 32566, 32609, and 34541.

32594 (AED-CONF-72-616-002, pp 139-149) INVESTIGATION OF THE RADIOIRON INTAKE AFTER INCORPORATION OF ^{89}Sr-^{90}Y IN FEMALE MICE. Moenig, H.; Steinbach, K. H. 1972. (In German).

From meeting of the Schutzkommission beim Bundesministerium des Innern; Freiburg, F. R. Germany (12 May 1972).

3 figs.; 2 tabs.; 8 refs. Available from ZAED.

In Schutzkommission of the Federal Ministry of the Interior. First, experiments for investigation of the iron intake in mice

following whole-body irradiation are described. The animals received an i.p. injection of 0.2 ωCi of ^{59}Fe 24 h after irradiation. Blood samples were taken on the first to seventh day after irradiation with a ^{60}Co source; doses ranged between 300 and 150 rads. The disturbance of iron intake was found to be dose-dependent. The limit value for clear detection of disturbed ^{59}Fe-intake is approx. 40 rads. This experiment was followed by another for investigating the effect of chronic radiation exposure due to incorporation of radiostrontium. For this purpose, mice were injected with 2.5 or 5.0 ωCi of a ^{90}Sr - ^{90}Y solution. After 2–64 days, the animals received an i.v. injection of 0.3 ωCi of ^{59}Fe, blood samples being taken on the 1st to 28th day. Iron intake was found to decrease up to an interval of 4 d between injection of ^{90}Sr and ^{59}Fe, with the effect of the 5.0 ωCi of ^{90}Sr being strongest. This process is reversed after an interval of 8 d, with the effect of the higher activity again being stronger. (GE)

32595 (AED-CONF-72-616-003, pp 151-162) COURSE OF FOOD INTAKE AND WEIGHT FOLLOWING SINGLE AND TWO-FOLD IRRADIATION. Schraub, A.; Sattler, E. L.; Jonas, H. 1972. (In German).

From meeting of the Schutzkommission beim Bundesministerium des Innern; Freiburg, F. R. Germany (12 May 1972).

17 figs.; 4 refs. Available from ZAED.

In Schutzkommission of the Federal Ministry of the Interior.

Rats were made to inhale a salt aerosol activated by addition of ^{212}Pb. Another group of rats received whole-body irradiation from a 20 kCi ^{60}Co source with a dose rate of 2500 R/h. The weight of the animals was determined daily. The total amount of food taken in daily was determined for the whole group of animals kept in the cage (n = 5). Food intake and weight clearly exhibited a two-phase dose-response relationship after a single whole-body irradiation. The effect of a second irradiation after 38 d and subsequent to different doses of conditioning radiation showed that the first reaction is less dependent on the conditioning dose than the second reaction. In the daily food intake after inhalation of different doses of the ^{212}Pb aerosol, the first phase of reduction showed a clear dose dependence. Whole-body irradiation after inhalation of the radioactive aerosol results in a higher sensitivity towards the test dose when reducing the interval between inhalation and irradiation. With the help of the parameters discussed in the paper and by means of a 2nd irradiation it may be possible in the future to get better information about the level of a sublethal radiation dose due to inhalation or irradiation. (GE)

32596 (CEA-R-4592) STUDY OF THE MECHANISMS OF EARLY MOBILIZATION OF NON-TRANSFERABLE ELEMENTS IN THE LUNG AFTER INHALATION. Ducousso, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Sep 1974. 100p. (In French). Dep. NTIS (US Sales Only) $8.00.

Thesis.

An original technique of administration of radionuclides by inhalation and measurement of the early absorption is described. The transfer of Ce^{3+} and La^{3+} was thus measured by various parameters: rare earth lung burdens, influence of DTPA administration as a function of the rare earth lung burdens, the delay of administration of the chelating agent, its route of administration into the body, and the amount delivered. A therapeutic procedure of respiration contamination using DTPA was deduced from these data. Also a number of questions were raised about the physiological processes involved in the absorption of radionuclides, either chelated or not. Further experiments made it possible to specify the physico-chemical, biochemical, and cellular processes involved in the early mobilization of non-transferable inhaled elements. (auth)

32597 (EUR-5160e) ACCUMULATION AND RETENTION OF CHROMIUM-51 BY FRESHWATER ZOOPLANKTON. Baudouin, M. F.; Scoppa, P. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). 1974. 23p. Dep. NTIS (U. S. Sales Only) $4.25.

The importance of direct absorption on ^{51}Cr accumulation by three representative species of freshwater zooplankton was studied. Net uptake of trivalent ^{51}Cr was rapid, but accumulation did not occur to a considerable extent. Most of the ^{51}Cr accumulated by Cyclops abyssorum and Eudiaptotomus padanus had a half-life of only a few hours. These copepods, when exposed to chromate, did not accumulate hexavalent ^{51}Cr. The cladoceran Daphnia hyalina, which is very sensitive to the toxic action of chromate, accumulated only small amounts of ^{51}Cr. It was concluded that the transfer of ^{51}Cr from water to zooplankton does not play an important role in the radioactive contamination of aquatic food chains. (auth)

32598 (UCD-472-121, pp 20-22) INFLUENCE OF AGE ON THYROIDAL ^{131}I UPTAKE, RETENTION AND DOSE. Book, S. A. Jun 1974.

In annual report, fiscal year 1974.

Average peak ^{131}I uptake increased from 8.5% of the administered dose in beagle pups 10 days of age to 24% at 70 days of age, then declined to adult values of 11 to 15%. The % uptake/g of thyroid was highest in 20- to 70-day-old pups, averaging 6 to 7 times the adult values. Retention of ^{131}I was longest (T_E = 5.8 days) in 10-day-old pups, and shortest (T_E = 3.7 days) in 70-day-old pups; adult T_E's consistently averaged 4.5 to 5 days. The radiation dose to the thyroid averaged 40 to 60 rads/μCi for pups less than 3 months of age, 4 to 6 times the adult value. Individual pups, however, received 2 to 9 times the adult dose. A single oral administration of ^{131}I to a pregnant dog in the last week of gestation resulted in 48-hr values of 10.4% of the administered dose (7.3%/g) for the maternal gland; the thyroids of her pups contained 0.5 to 1.2% of the dose, or 6 to 11%/g. (auth)

32599 (UCD-472-121, pp 36-39) COMPARATIVE RETENTION OF ^{226}Ra IN BONE RELATIVE TO AGE AT INJECTION. Momeni, M. H.; Parks, N. J.; Wolf, H. G.; Jow, N.; Bradley, E. W. Jun 1974.

In annual report, fiscal year 1974.

Uptake and early retention of ^{226}Ra were studied in beagle dogs after 8 semimonthly injections starting at 2, 4, or 14 months of age. Initial uptake was 72, 78, and 39% respectively for the various age groups. About 90% of the initially incorporated ^{226}Ra was retained after 1 yr. Rn/Ra, estimated parametrically, was higher in the 2- and 4-month-old groups than in the 14-month-old animals. The concentration of radium in humeri and vertebral bone was higher in trabecular corings than in processes. This vertebra contained between 0.8 and 1.3% of the total body burden; the content was independent of the age at administration. (auth)

32600 NATURAL ^{226}Ra AND ^{228}Th IN THYROIDS OF CATTLE FROM NIGERIA. Ekpechi, O. L. V. (Univ. of Nigeria, Enugu); Van Middlesworth, L.; Cole, G. pp 401-407 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

Natural ^{226}Ra and ^{228}Th are concentrated in occasional cattle thyroids until the concentration has exceeded ten times that found in bones of the same animals. These α emitters with their radioactive daughters have been found by γ spectroscopy in less than 1% of cattle from the United States of America and 10% of cattle from the endemic goitre area of Colombia. Recently, it was found by γ spectroscopy that 70 to 92% of thyroids from 135 cattle from Nigeria contained easily detectable quantities of ^{228}Th, possibly mixed with ^{226}Ra. Radioautographs of these thyroids revealed highly concentrated sources of α particles distributed throughout the thyroid. The sources are 20 to 40 μm in diameter; they diffuse polarized light and are usually located in the colloid storage of the thyroid at the apical edge of follicular cells. It is estimated that the thyroids contain 10^4 to 10^6 of these radioactive sources and each one emits one α particle every 1 to 10 days. Measurements of the α tracks suggest that each 6.5 MeV α particle produces 9000 rad along its track and many of these tracks traverse thyroid cells. Therefore, the normal thyroid concentrates natural radium and this may constitute a source of some "naturally occurring" thyroid disease. (auth)

32601 CLINICAL AND EXPERIMENTAL INVESTIGATIONS ON THE SIGNIFICANCE, INDICATION, AND LIMITING FACTORS OF TISSULAR CLEARANCE WITH Na^{131}I, RISA, AND COLLOIDAL ^{198}Au. Miclutia, M.; Holan, T. (Lucrare Efectuato, Cluj). Chirurgia (Bucharest); 22: No. 12, 1097-1104(Dec 1973). (In Rumanian).

Experimental and clinical studies were carried out on the significance of crystalloid and macromolecular tissular clearance. Tissular clearance is considered to be an overall test of the interstitial circulation, conditioned physiologically and pathologically by a multitude of circulatory, metabolic, hormonal coordinating factors, etc. The main altered component can be determined (venous or lymphatic capillary) by successive performance of tissular clearance with crystalloids and macromolecules, without obtaining data on the causal factor. The principal sources of error are: non-compliance with the technical conditions, the presence of oedema and trophic disturbances of the integument. (auth)

32602 COLD STRESS INDUCED CHANGES IN THE UPTAKE AND DISTRIBUTION OF RADIOLABELLED MAGNESIUM IN THE BRAIN AND PITUITARY OF THE RAT. Sabbot, I.; Costin, A. (Univ. of California, Los Angeles). Experientia; 30: No. 8, 905-906(15 Aug 1974).

Rats were drenched in cold water at 4°C for 30 min. Five min later a dose of 1 μCi of ^{28}Mg was injected into the carotid artery of each animal and the animals were decapitated. A scintillation

counter was used for measuring the radioactivity of the following tissues: cortex, hippocampus, thalamus, superior colliculus, cerebellum, medulla, and the pituitary. Stress conditions induced significant increases of Mg uptake in the cortex, hippocampus, and pituitary. A figure is presented to show comparisons of ^{28}Mg and ^{45}Ca uptake by the cortex, hippocampus, and pituitary. (HLW)

32603 AUTOMATIC ASSAY OF THE DISTRIBUTION OF ^{3}H-, ^{14}C-, AND ^{32}P-LABELLED COMPOUNDS WITHIN AN EARLY CHICK EMBRYO BY A SEMICONDUCTOR DETECTOR. Tykva, R.; Jelinek, R.; Seifertova, M. (Inst. of Organic Chemistry and Biochemistry, Prague). Experientia; 30: No. 8, 974-976(15 Aug 1974).

A semiconductographic device for simultaneous determination of several radionuclides is described. Chick eggs were injected with the following compounds: ^{32}P-orthophosphate, ^{14}C-orotic acid, ^{3}H-thymidine, ^{14}C-L-Leucine, and ^{3}H-6-azauridine. After 60 min of incubation, the embryos were withdrawn and kept on a slide until dry. Resolution of the radionuclides was accomplished by an amplitude analysis in three counting channels. A table is presented to show incorporation of the compounds in nucleic acids and proteins, and graphs are presented to show distribution of labelled substances in the embryo. (HLW)

32604 COMPARISON OF THE METABOLISM OF IRON-LABELED TRANSFERRIN (Fe.TF) AND INDIUM-LABELED TRANSFERRIN (In.TF) BY THE ERYTHROPOIETIC MARROW. McIntyre, P. A.; Larson, S. M.; Eikman, E. A.; Colman, M.; Scheffel, U.; Hodkinson, B. A. (Johns Hopkins Medical Institutions, Baltimore). J. Nucl. Med.; 15: No. 10, 856-862(Oct 1974).

Indium-111-transferrin (TF) has been described as a hematopoietic marrow scanning agent. The prupose of this study was to compare the metabolism of ^{111}In-TF and ^{59}Fe-TF by the erythropoietic marrow in dogs and rabbits. (CH)

32605 EFFECTS OF NEUROTRANSMITTERS AND OTHER PHARMACOLOGICAL AGENTS ON ^{32}P INCORPORATION INTO PHOSPHOLIPIDS OF THE IRIS MUSCLE OF THE RABBIT. Abdel-Latif, A. A. (Medical Coll. of Georgia, Augusta). Life Sci.; 15: No. 5, 961-973(1 Sep 1974).

The effects of norepinephrine, other catecholamines, α- and β- adrenergic receptor blocking agents and acetylcholine on the incorporation of ^{32}P into phospholipids of the iris muscle of the rabbit were studied in vitro. There was a marked stimulation of ^{32}P into phosphatidic acid (PhA), phosphatidyl inositol (PhI) and to a much lesser extent phosphatidyl choline but not into phosphatidyl ethanolamine. The increase in the ^{32}P labeling of PhA and PhI in the presence of norepinephrine or acetylcholine, which ranged from 2- to 6-fold, was found to be time- and concentration-dependent. Under our experimental conditions, several adrenergic drugs, including DL-propranolol, phentolamine, isoproterenol, phenylephrine, but not sotalol, increased markedly (nearly up to 5-fold) the ^{32}P incorporation into PhA and PhI of the iris. In contrast, phenoxybenzamine, an α-receptor blocker, blocked completely the stimulatory effects of norepinephrine on phospholipid synthesis. The stimulation of phospholipid synthesis by acetylcholine was completely abolished by atropine. Incorporation of ^{32}P into PhA and PhI was significantly increased in the presence of serotonin, dopamine, epinephrine or histamine. Addition of γ-aminobutyric acid or cyclic AMP was ineffective. These observations suggest that in the iris muscle of the rabbit, which is innervated by cholinergic and adrenergic fibers, the phospholipid effect is probably a membrane effect that is not associated with synaptic transmission. (auth)

Microorganisms

32606 ISOTOPIC BEHAVIOR OF SULFATE OXYGEN IN THE BACTERIAL REDUCTION OF SULFATE. Mizutani, Y. (Nagoya Univ., Japan); Rafter, T. A. Geochem. J. (Nagoya); 6: No. 4, 183-191(May 1973).

The oxygen isotopic ratio of the sulphate remaining in the bacterial sulfate reduction was found to be dependent on the oxygen isotopic ratio of the water in which the sulfate was reduced by bacteria. This finding is interpreted by a mechanism, in which the sulfate exchanges oxygen isotopes with the water through the intermediates in the bacterial reduction of sulfate sulfide. (auth)

New Tracer Techniques

Refer also to abstracts 31485, 31671, 31702, 32471, 32561, 32575, 32589, 32591–32593, 34473–34486, and 34488–34494.

32607 (CONF-740708-46) PORTOHEPATOGRAPHY BY RECTAL ADMINISTRATION OF SODIUM IODIDE-131 IN EARLY DIAGNOSIS OF PORTAL HYPERTENSION. Sutarman. (Pertamina Center Hospital, Djakarta (Indonesia). Dept. of Nuclear Medicine). 1974. 12p. (SM-185/69). Dep. NTIS (US Sales Only) $4.00.

From symposium on dynamic studies with radioisotopes in clinical medicine and research; Knoxville, Tennessee, USA (15 Jul 1974).

An application of a modified rectal ^{131}I resorption test is proposed as a portohepatographic procedure, which could serve as a routine test for the early diagnosis of portal hypertension in cirrhosis or other conditions affecting the blood circulation in the liver. This will enable the surgeon to perform an early portosystemic shunt operation, to prevent the development of esophageal varices and the much dreaded hemorrhages from such varices. The procedure could also be used to check the continued patency of a shunt, once a shunt operation has been carried out. (auth)

32608 (CONF-740708-50) QUANTITATIVE EVALUATION OF EXTRACRANIAL NEUROSURGICAL CSF SHUNTS. Touya, E.; Perillo, W.; Lalanne, A.; Gherzi, J.; Lux Souza, O.; Garcia Guelfi, A. (Universidad de la Republica, Montevideo (Uruguay). Centro de Medicina Nuclear). 1974. 12p. (SM-185/72). Dep. NTIS (US Sales Only) $4.00.

From symposium on dynamic studies with radioisotopes in clinical medicine and research; Knoxville, Tennessee, USA (15 Jul 1974).

The first results obtained with a new method for quantitative evaluation of extracranial cerebrospinal fluid (CSF) shunts are presented. The method consists in the injection of a radiopharmaceutical ^{99m}Tc-pertechnetate or ^{113m}In-FeDTPA in the shunt reservoir and the recording of the radioactivity decay in the reservoir and in the valve. A γ camera and selector of interesting areas was used for detection. The information was stored in punch tape and the data processed in a PDP 12 computer. The CSF shunt flow was estimated from the mean transit time and the volume of shunt reservoir and valve. In four patients with hydrocephalus the test showed no CSF shunt flow while in nine patients flows between 0.02 and 0.19 ml/mm were found. The method described is simple, quick and safe and it can be repeated as many times as necessary. It offers efficient periodical control of shunted patients. Early recognition of shunt dysfunction can thus be reached. (auth)

32609 (CONF-740708-51) ^{131}I-ASIALO-α_1-ACID GLYCOPROTEIN, A NEW PHARMACEUTICAL FOR DYNAMIC LIVER FUNCTION STUDIES. van Rijk, P. P.; de Graaf, C. N.; van den Hamer, C. J. A. (Rijksuniversiteit Utrecht (Netherlands). Instituut voor Nucleaire Geneeskunde; Interuniversitair Reactor Instituut, Delft (Netherlands)). 1974. 10p. (SM-185/70). Dep. NTIS (US Sales Only) $4.00.

From symposium on dynamic studies with radioisotopes in clinical medicine and research; Knoxville, Tennessee, USA (15 Jul 1974).

Glycoprotein labeled with ^{131}I was intravenously injected in rats. This material, in contrast to the unmodified protein, rapidly disappeared from the blood circulation and accumulated in the liver. After rapid degradation the label was returned to the circulation. The distribution of the radioactivity in normal, anesthetized, and hepatoma bearing rats was tested by means of the γ camera. The time-activity curves of these three groups showed significant differences indicating that this radiopharmaceutical can be used for liver function studies. (auth)

32610 (CONF-740708-61) "HARDWARE FUNCTION ANALYSERS" FOR THE ON-LINE ESTIMATION OF DYNAMIC PARAMETERS. Van Herk, G. (Rijksuniversiteit Groningen (Netherlands). Academisch Ziekenhuis). 1974. 7p. (SM-185/99). Dep. NTIS (U. S. Sales Only) $4.00.

From symposium on dynamic studies with radioisotopes in clinical medicine and research; Knoxville, Tennessee, USA (15 Jul 1974).

Processing of data from radionuclide dynamic function studies is most frequently performed with a digital computer. In many instances, however, this treatment seems more sophisticated than routine investigations require, since the clinician often needs information about the shape of a curve only or just an estimate of one resulting parameter to be able to interpret the performed dynamic study. As long as simple mathematical operations can be applied using the momentary count rates only, there is no need to store the raw data. It is then possible to process the data on-line with specific hard-wired units, so called hardware function analysers. Such units use at the input either the digital pulses from the single channel analyser or else the analog signal out of the ratemeter. Actually, signals from more than one energy window (dual tracer), and from more than one detector may be used as input variables. The computed parameter appears as a voltage at the output of the processor, calibrated in the desired

units, and can be displayed with a (digital) voltmeter, paper chart recorder, or any other appropriate read out. The design and application of a number hardware function analyzers are described, each of which performs specific operations according to the assumed functional model. (CH)

32611 (COO-3167-109) APPLICATIONS OF RADIOISOTOPE TECHNIQUES TO CLINICAL VETERINARY MEDICINE. Annual Progress Report. Kallfelz, F. A. (Cornell Univ., Ithaca, N. Y. (USA); New York State Veterinary Coll., Ithaca (USA). Dept. of Physical Biology). 1974. Contract AT(11-1)-3167. 98p. Dep. NTIS $8.00.

Separate abstracts were prepared for the five sections of this report. (CH)

For abstracts of individual sections see: 32612–32615 and 34529.

32612 (COO-3167-109, pp vp Paper 1) RADIOIMMUNOASSAY FOR COMPARISON OF SERUM TOTAL THYROXINE AND SERUM TRIIODOTHYRONINE LEVELS IN THE EVALUATION OF THYROID FUNCTION IN THE DOG. Kallfelz, F. A.; Wallace, R. J. 1974.

In applications of radioisotope techniques to clinical veterinary medicine. Annual progress report.

The role of serum triiodothyronine levels in normal thyroid physiology of the dog was studied. Radioimmunoassay methods were used to investigate the normal levels of serum triiodothyronine and compare responses to thyrotrophin of both total serum thyroxine and total serum triiodothyronine concentrations. (CH)

32613 (COO-3167-109, pp vp Paper 2) STUDIES OF ALBUMIN METABOLISM IN DOGS USING ^{51}Cr AND ^{125}I LABELED ALBUMIN. Kallfelz, F. A.; Wallace, R. J. 1974.

In applications of radioisotope techniques to clinical veterinary medicine. Annual progress report.

Results of studies using ^{51}Cr- or ^{125}I-labeled albumins support the previous evidence that gastroenteric protein loss accounts for almost half of the normal plasma albumin turnover in the dog as opposed to reports in man which indicate that only 2 to 15% of plasma protein loss is by way of the gut. The techniques used in the study are also of value in estimating enteric protein loss in pathological conditions, where increased loss is suspected. It was found that up to 25% of the dose was lost in the feces in an initial four day period in some cases as opposed to normal loss of only about 1 to 4% of the dose during the same time period. (CH)

32614 (COO-3167-109, pp vp Paper 3) $^{51}CrEDTA$ AS A GASTROINTESTINAL REFERENCE MARKER IN THE NEONATAL BOVINE CALF. Ward, D. E.; Tennant, B. C.; Kallfelz, F. A.; Stevens, C. E. 1974.

In applications of radioisotope techniques to clinical veterinary medicine. Annual progress report.

Orally administered trace amounts of $^{51}CrEDTA$ chelate were used as a fluid transit marker in 24 and 151 hr old bovine calves. Approximately 32% and 16%, respectively, was absorbed and excreted in the urine in 48 hrs. Administering the trace dose orally mixed in saline or bovine colostrum had no effect on the amount absorbed and excreted. Of the $^{51}CrEDTA$ absorbed, less than 0.5% of an oral dose was calculated to re-enter the g.i. tract, and this amount showed no preferential site of entry into the lumen. (auth)

32615 (COO-3167-109, pp vp Paper 5) VETERINARY NUCLEAR MEDICINE. Kallfelz, F. A.; Comar, C. L.; Wentworth, R. A. 1974.

In applications of radioisotope techniques to clinical veterinary medicine. Annual progress report.

A review is presented of the present scope and possible applications of nuclear medicine techniques in veterinary medicine. It is pointed out that developments in human medicine can be used as guidelines to select those techniques that may be applicable in the veterinary field. Factors that have tended to restrict the application of nuclear medicine procedures in the veterinary field are discussed. These include the value of the animal in relation to the cost of diagnosis, the necessity of heavy sedation or general anesthesia for imaging procedures, and the cost of equipment. (CH)

32616 (INIS-mf-1369) ON-LINE COMPUTING SYSTEM FOR THE DIAGNOSTICS IN NUCLEAR MEDICINE. Gahr, H.; Pangritz, H. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F.R. Germany)). [nd]. 4p. INIS.

From 1st international symposium on CAMAC in real-time computer applications; Luxembourg (4 Dec 1973).

An on-line computing system is described for routine measurements in nuclear medicine, like test of the thyroid gland, nephrography, and blood volume evaluation. In order to develop a system that can be adopted by other users with different computers, the CAMAC Branch Highway was chosen to be the only linkage between the computer and the peripherals necessary for the measurements, for the computer aided diagnostics and for the output of medical reports. (auth)

32617 (PB-231497) QUANTIFYING THE SIZE OF ISCHEMIC, INFARCTED, AND/OR SCARRED MYOCARDIUM-METHODS SUITABLE FOR USE IN LIVING MAN; IDENTIFICATION OF REGIONAL MYOCARDIAL PERFUSION DEFECTS BY RADIOISOTOPES SCINTISCANNING. Annual Report, January–December 1973. Eber, L. M.; Poe, N. D. (California Univ., Los Angeles (USA)). Feb 1974. Contract N01-HL-12491. 29p. NTIS $3.25.

Radiopharmaceutical development, animal experimentation, and clinical correlations are described. Scanning is done with a gamma camera and the signal processed on a Hewlett-Packard computer. Radioisotope compounds developed and evaluated have included cyclotron produced potassium-43, carbon-11-labeled oleic acid, terminal-iodine-labeled fatty acids, fluorine-18-labeled ethanol, and carbon-11-labeled ethanol, as well as hot spot scanning with technetium-99-labeled tetracycline and fluorescein derivatives. Studies showed the variation in isotope patterns with coronary occlusions in anesthetized animals, with stress in normal animals and in patients with coronary artery disease with and without definite infarctions. Continued new radiopharmaceutical development and testing are planned. (GRA)

32618 (UR-3490-604) INTRACELLULAR CALCIUM AND HEPATIC METABOLISM. Barrett, P. Q. (Rochester Univ., N.Y. (USA). Dept. of Radiation Biology and Biophysics). 1974. Contract AT(11-1)-3490. 88p. Dep. NTIS $7.50.

Thesis.

Liver cells isolated from adult rat by an enzymatic perfusion technique were shown to be capable of maintaining a linear rate of glucose production for 90 minutes. Ninety to ninety-five percent of the cells in each preparation were found to retain their plasma membranes intact as indicated by trypan blue exclusion. The isolated cells maintained a constant cellular calcium content and a 20-fold transmembrane potassium gradient for at least 90 minutes. Cellular calcium exchange was shown to be inhibited by rotenone and CCCP. Moreover, in the presence of rotenone, the addition of oligomycin caused a further inhibition of cellular calcium exchange. Incubation at 4°C led to enhanced cellular exchange which was, in part, energy dependent. Radiocalcium efflux from liver cells prelabeled with ^{45}Ca was accelerated by the presence of rotenone and CCCP. Unlike ^{45}Ca influx, ^{45}Ca efflux from prelabeled cells showed no dependence on extracellular P_i. These characteristics of liver cell calcium exchange are discussed in relation to the known properties of mitochondrial calcium accumulation. Liver cells were shown to be hormonally responsive, exhibiting increased rates of glucose production in response to various concentrations of epinephrine. Epinephrine produced changes in calcium exchange processes which could be correlated with alterations in carbohydrate metabolism. Hormone concentrations which significantly stimulated glucose production significantly enhanced calcium uptake. Concentrations which caused minor alterations in medium glucose exhibited either no effect or an inhibitory effect on calcium uptake. The time course of the alterations induced by 10^{-5} M epinephrine in the cellular calcium exchange pattern suggested mitochondrial involvement in the hormonal response. These alterations were abolished in the presence of rotenone. Catecholamine blocking agents, dihydroergotamine and propranolol, were used in an attempt to dissociate the measured change in glucose production from the observed redistribution of cellular calcium evoked by 10^{-5} M epinephrine. Dihydroergotamine was capable of totally blocking epinephrine induced calcium exchange, but was not capable of abolishing the induced glucose response. Propranolol had no effect on glucose production, yet it was effective in diminishing the stimulation of calcium exchange elicited by epinephrine. Taken at face value, these data suggest that the measured change in metabolic activity and the observed redistribution of calcium are two separable responses independently evoked by epinephrine. The data obtained strongly support the current hypothesis that mitochondria are important in the homeostasis of intracellular calcium but do not permit a final assessment of the importance of mitochondrial control of calcium ion fluxes in initiating a metabolic response. (auth)

32619 RADIOIMMUNOASSAY FOR PANCREATIC CARBOXYPEPTIDASE B IN HUMAN SERUM. Geokas, M. C.; Wollesen, F.; Rinderknecht, H. (Veterans Administration Hospital, Los Angeles). J. Lab. Clin. Med.; 84: No. 4, 574-583 (Oct 1974).

A sensitive and specific radioimmunoassay for human pancreatic carboxypeptidase B (HCOB) in serum has been developed. Two main forms of HCOB were isolated and partially purified from human pancreatic juice (HPJ), HCOB-I, and HCOB-II. The latter enzyme was used as an antigen in the production of antisera in rabbits. HCOB-II further purified by electrofocusing was used as

radioiodinated label and as standard in the assay. The sensitivity of the assay was determined to be better than 200 pg per milliliter. Cross-reactivity with HCOB-I was 9.1% and with porcine COB, 3.7%. Heating of human serum diluted 1:5 at 65°C for 3 hours destroyed all radioimmunoassayable enzyme. A serum dilution curve was parallel to the standard curve. Preliminary studies with the HCOB-II radioimmunoassay have shown a mean concentration of 10.4 ng per milliliter (S.D. ± 4.2) in sera of 13 normal fasting males, and a mean concentration of 64.8 ng per milliliter (S.D. ± 34.4) in sera of 5 patients with acute pancreatitis. In 3 patients with acute recurrent pancreatitis in remission, HCOB-II concentrations in serum increased considerably following the injection of secretin. (auth)

32620 CARBON DIOXIDE AS AN OTIC VASODILATOR. Pollock, R. A.; Jackson, R. T.; Clairmont, A. A.; Nicholson, W. L. (Emory Univ., Atlanta). Arch. Otolaryngol.; 100: No. 4, 309-313(Oct 1974).

Carbon dioxide (CO_2) is a potent dilator of cerebral blood vessels. In this experiment, the effect of CO_2 on the blood flow of temporal bone, mastoid bone, brain, and several other tissues was measured using radioactive microsphere techniques. Mongrel dogs were tested with one of four gas mixtures for times varying from ten minutes to two hours. Control blood gas values and cerebral blood flows corresponded quite closely to values reported by investigators using other techniques. Temporal bone blood flow prior to exposure to CO_2 was approximately one tenth that of brain. Following administration of CO_2, both brain and temporal bone blood flows were markedly increased. The effect of 10% CO_2 on brain tissue was prolonged, but in temporal bone, the increase in blood flow progressively diminished with time. Maximum otic blood flow was obtained using 10% CO_2 – 90% O_2. (auth)

32621 AN UNUSUAL CONCENTRATION OF RADIOPERTECHNETATE IN A PATIENT WITH THYROID CANCER. Lamoureux, J. (Notre-Dame Hospital, Montreal). Amer. J. Roentgenol., Radium Ther. Nucl. Med.; 121: No. 4, 714-715(Aug 1974).

A 19 year old female with a histologically proven papillary and follicular adenocarcinoma of the thyroid, for which total thyroidectomy had been carried out 13 years previously, was investigated for a possibility of lung metastases. A thoracic scan was obtained immediately after administration of 4 mc $^{99m}TcO_4^-$ and again 3 hours later. No lung lesions were demonstrated on the scans; however, on the delayed scan of the chest, the breasts were clearly revealed, which confirmed the finding that nonlactating breasts have the potential to concentrate radioiodide and radiopertechnetate at levels detectable on scans. (auth)

32622 EVIDENCE FOR A PRO-CALCITONIN. Roos, B. A.; Okano, K.; Deftos, L. J. (Univ. of California, San Diego). Biochem. Biophys. Res. Commun.; 60: No. 3, 1134-1140(8 Oct 1974).

The biosynthesis of calcitonin was studied using radioimmunochemical methods and suspensions of calcitonin-producing cells derived from trout ultimobranchial glands. [^{14}C]leucine was incorporated into cell proteins in a linear fashion for up to 36 hrs. Acid-extracted cellular radioactivity could be precipitated by trichloroacetic acid and calcitonin antiserum. Chromatography of the cell extracts revealed two distinct peaks of radioimmunoassayable and immunoprecipitable calcitonin activity. One peak coeluted with radioiodinated calcitonin, the other as a higher molecular weight species. The relative incorporation of [^{14}C]leucine into the higher and lower molecular weight peaks during "pulse-chase" experiments was consistent with a precursor-product relationship between them. (auth)

32623 RADIOMETRIC MEASUREMENT OF METABOLIC ACTIVITY OF MYCOBACTERIUM LEPRAEMURIUM. Camargo, E. E.; Larson, S. M.; Tepper, B. S.; Wagner, H. N. Jr. (Johns Hopkins Medical Institutions, Baltimore). Appl. Microbiol.; 28: No. 3, 452-455(Sep 1974).

A sensitive and nondestructive radiometric method was applied to the detection of metabolism of Mycobacterium lepraemurium, as a model for the study of the metabolism and substrate requirements of M. leprae. The method is based on the measurement of the $^{14}CO_2$ produced through the bacterial conversion of [U–^{14}C]acetate or [U–^{14}C]glycerol by 7×10^8 bacteria suspended in 10 ml of either a simple buffer system (K-36) or a complex medium (NC-5). Metabolism of the bacilli was easily detected within 3 days after inoculation and was measured daily. NC-5 medium supported metabolism of M. lepraemurium for several weeks longer than the simple K-36 buffer. The radiometric technique shows promise as a rapid and efficient system for evaluating the metabolism of mycobacteria without introducing any changes in the physiologic state of the organisms, studying their metabolic pathways; determining conditions potentially favorable for multiplication of these organisms in vitro, and studying their susceptibility to inhibition by drugs. (auth)

32624 STUDY OF LIPID-^{131}I ABSORPTION BY THE METHOD OF RADIOMETRY OF THE WHOLE BODY. Kaplan, M. A.; Gabuniya, R. I.; Sereda, M. G. (Scientific-Research Inst. of Medical Radiology, Moscow). Med. Radiol.; 19: No. 10, 13-16 (Oct 1974). (In Russian).

The authors describe the method of studying fat absorption labelled with ^{131}I with the aid of radioactivity measurement of the whole body of the patient after per os administration of lipids. The article shows the advantages of this method over standard radioisotope tests of fat absorption assessment. A decrease of lipid absorption was revealed after gastric resection in cases of gastric carcinoma and diabetes mellitus. (auth)

32625 METHOD OF ASSESSMENT OF K CONTENT IN HEALTHY PERSONS IN RADIOMETRY OF THE WHOLE BODY. Kruglova, Z. G.; Gabuniya, R. I.; Kruglov, A. S.; Bogolyubov, V. M.; Lyskova, M. N. (Scientific-Research Inst. of Medical Radiology, Moscow). Med. Radiol.; 19: No. 10, 33-38(Oct 1974). (In Russian).

An assessment of recurrency and stability of some indices of K content in the human organism has been made: general weight of K, relation between K quantity, the weight and the surface area of the body. As a result of measurement of K content by the radiometry method of the whole body made in 276 persons of both sexes in the norm the authors established that relation between the general K content in the organism and the ideal weight of man according to A. A. Pokrovsky has the greatest stability with considerable fluctuations of height and weight of the patients. The values of this parameter were determined for various age groups and can serve as the initial index of K content when studying disorders of K metabolism in different diseases. An amendment has been derived which made it possible to increase the accuracy of K content measurement by the radiometry method of the whole body in examining the patients whose weight differed from the normal one, and the height-weight indices differed from the phantom standard. (auth)

32626 SIMPLIFIED METHOD FOR THE SEPARATION OF STEROID HORMONES AND ITS APPLICATION IN RADIOLIGAND ASSAYS. Schiller, H. S.; Mahler, E.; Brammall, M. A.; Anderson, P. H. (Univ. of Washington, Seattle). Anal. Lett.; 7: No. 7, 473-481(1974).

A simplified method for separating the major progestogens, estrogens, and androgens in plasma was developed for use in both competitive protein binding assays (CPBA) and radioimmunoassays (RIA). The method, based on liquid-liquid partition chromatography, utilizes microcolumns consisting of plastic disposable syringes packed with celite : ethylene glycol. The method was applied to the plasma measurement of progesterone by CPBA and estradiol and testosterone by RIA. (auth)

32627 SIMPLIFIED RADIOIMMUNOASSAY OF ANGIOTENSIN II. Mion, H.; Dupont, M.; Roche, M.; Crastes de Paulet, A.; Barjon, P. (Clinique Saint-Charles, Montpellier, France). Biomedicine; 21: No. 3, 126-131(20 Mar 1974).

A simplified radioimmunoassay method for angiotensin II is described. The high specificity of the angiotensin II antiserum allows the direct determination of angiotensin II without preliminary extraction of the hormone. Thanks to the sensitivity, one may determine as little as 5 pg of hormone. The reproducibility is good, the maximum range between two determinations of the same sample is 15%. An excellent correlation is obtained between plasma levels of angiotensin II and plasma renin activity in man. (FR)

32628 EXPERIMENTS WITH 1-^{14}C-ACETATE ON THE LIPID METABOLISM OF HUMAN LIVER BIOPSIES AND THEIR DEPENDENCE UPON THE DIETARY FAT CONTENT. Oette, K.; Philippen, R.; Lanckohr, H. (Koeln Univ. (F. R. Germany). Medizinische Klinik). 162: No. 2, 83-103(1974). (In German). 6 figs.; 13 tabs.; 29 refs.

Detailed data on the methods used for metabolic experiments on human liver biopsy material are presented. 1-^{14}C-acetate experiments on the fatty acid synthesis and the esterification patterns of synthesized fatty acids demonstrated a remarkable dependence on the fat–carbohydrate content of the diet on human material. By increasing the dietary fat content fatty acid neosynthesis ceased almost completely at 55 cal % fat in the diet. The remaining activity was supposed to be mainly due to chain elongation products. Elongation reactions are influenced probably only to a minor degree by dietary variations. This hypothesis is supported by characteristic changes in the esterification patterns. Experiments concerning the adaptation on a high fat diet showed that the activity of the enzymatic system for the fatty acid neosynthesis decreased slowly within 3-6 days. The problem of

using ^{14}C-acetate for the quantitative determination of the fatty acid neosynthesis is demonstrated and discussed. The results were correlated with histological data and with 2 cases of type IV hyperlipoproteinemia. (auth)

32629 ANIMAL EXPERIMENTS ON THE PHARMACOKINETICS AND BIOTRANSFORMATION AFTER ADMINISTRATION OF RADIOACTIVE LABELLED PROPIRAMFUMARATE. Duhm, B.; Maul, W.; Medenwald, H.; Patzschke, K.; Wegner, L. A. (Farbenfabriken Bayer A. G., Wuppertal (F. R. Germany). Isotopen-Institut). Arzneim.-Forsch.; 24: No. 4A, 632-643(Apr 1974). (In German).

14 figs.; 6 tabs.; 16 refs.

The kinetics and biotransformation of the ^{14}C-labelled analgetic N-(1-methyl-2-piperidino-ethyl)-N-(2-pyridyl)-propionamide-fumarate, (propiramfumarate, Bay 4503) were investigated in rats and dogs. The enteral absorption was almost complete. The rapid absorption from the small intestine resulted in an absorption rate comparable to that after s.c. administration. In rats, the speed and percentual total of the activity excreted after oral or i.v. doses ranging from 0.05 to 50 mg/kg, were not dose-dependent. Approximately 10 h after administration the renal elimination had been practically completed. Approximately 65% of the i.v. administered activity was excreted via the kidneys and the rest with the feces. Following oral administration, about 53% of the activity was eliminated in the urine. After oral or i.v. administration, dogs excreted approximately 80 to 90% of the administered activity via the kidneys. It was possible to detect more than 20 metabolites in the urine by chromatography and electrophoresis. The structure of the main metabolic product N-2-(2-pyridylamino)-propyl-N-propionyl-5-amino-valeric acid was determined and confirmed by synthesis. The distribution of activity in the organs of rats was determined quantitatively and whole-body autoradiographically. Following i.v. administration, a rapid drop of the activity in the blood and a rapid penetration into the tissues occurred. Relatively high concentrations of activity were determined in excretion organs as liver and kidneys. In the central nervous system and the cerebro-spinal fluid substantially lower concentrations of the activity were present. 48 hours after i.v. or oral administration less than 2% of the administered activity was found in the animal. (GE)

32630 CLINICAL EXPERIMENTS ON THE PHARMACOKINETICS OF PROPIRAMFUMARATE-^{14}C. Horster, F. A.; Duhm, B.; Maul, W.; Medenwald, H.; Patzschke, K.; Wegner, L. A. (Duesseldorf Univ. (F. R. Germany). 2. Medizinische Klinik und Poliklinik; Farbenfabriken Bayer A. G., Wuppertal (F. R. Germany). Isotopen-Institut). Arzneim.-Forsch.; 14: No. 4A, 652-657(Apr 1974). (In German).

8 figs.; 1 tab.; 9 refs.

The pharmacokinetics and biotransformation of the analgesic N-(1-methyl-2-piperidino-ethyl)-N-(2-pyridyl)-propionamide-fumarate (propiramfumarate, Bay 4503), was investigated on 8 healthy volunteers and 8 hospitalized patients. Single therapeutically effective doses of the drug labelled with ^{14}C in the methylene group were administered p.o. as well as i.v. At specific intervals samples of the serum, urine and faeces were taken and the activity content was tested. Further, the metabolities extracted from the urine were two-dimensionally (electrophoretically-chromatographically) separated and autoradiographically recorded. Excretion of activity after p.o. and i.v. administration is practically independent of dose and mode of application. Altogether, an average of approximately 80% of the administered activity is excreted renally. The biological half-life is approximately 7 h. The highest activity concentration in the serum is reached, at the latest, 3 h after oral administration. It is just as high as that present 3 h after intravenous administration of the same dose. Later there are no differences in the activity concentrations measured at specific intervals in dependence of the mode of administration. Enteral absorption of the substance is practically complete. (GE)

32631 LIQUID SCINTILLATION RADIOASSAY IN DISPOSABLE MICROCENTRIFUGE TUBES: RADIOIMMUNE PRECIPITATES AND OTHER APPLICATIONS. Schaffer, F. L.; Soergel, M. E. (Univ. of California, Berkeley). Appl. Microbiol.; 28: No. 2, 280-287(Aug 1974).

A simple, economical radioassay system employing disposable polypropylene microcentrifuge tubes was developed. Plastic adapters permitted automatic operation in liquid scintillation spectrometers. Counting efficiencies of ^{3}H, ^{14}C, ^{32}P, and ^{125}I in liquid scintillation cocktails and of ^{32}P by Cerenkov radiation (at lower efficiency in absence of added scintillator) were comparable to those in standard vials. Multipurpose use of the microtubes made the system versatile and expedient, e.g., collection of precipitates and radioassay in the same container. Collection of radioimmune precipitates was aided by a carrier inorganic precipitate, $Mg_2P_2O_7$. (auth)

32632 MODIFIED RADIOIMMUNOASSAY FOR MURINE SARCOMA-LEUKEMIA VIRUS GROUP-SPECIFIC ANTIGEN. Spira, G.; Biswal, N.; Dreesman, G. R. (Baylor Coll., Houston). Appl. Microbiol.; 28: No. 2, 239-244(Aug 1974).

Iodination of disrupted Moloney strain murine sarcoma-leukemia virus resulted in labeled group-specific (gs) protein which was subsequently purified on an isoelectrofocusing column. This iodinated purified gs antigen, prepared from a relatively small quantity of purified virus, was used in a radioimmunoassay. A radioimmunoassay inhibition method was developed so that antibody specific for mammalian C-type gs antigen could be measured in undiluted or low dilutions of test serum without altering the known reagents of the test. The gs antigen isolated from purified Moloney strain murine sarcoma-leukemia virus has an isoelectric point (pH 5.95) which is significantly lower than that reported for other murine leukemia viruses. (auth)

32633 LIQUID SCINTILLATION VIAL FOR CUMULATIVE AND CONTINUOUS RADIOMETRIC MEASUREMENT OF IN VITRO METABOLISM. Buddemeyer, E. U. (Johns Hopkins Medical Institutions, Baltimore). Appl. Microbiol.; 28: No. 2, 177-180(Aug 1974).

A two-compartment vial is described in which suspensions of bacteria, cells, or tissues may be cultured and their growth and metabolism measured radiometrically by using a liquid scintillation counter. The device consists of a scintillation vial lined with a cylinder of scintillating paper into which is placed a sterilized inner culture vial containing a carbon-14 substrate. The assembled device can be carried by the sample transport systems of conventional liquid scintillation counters. Evolved $^{14}CO_2$ is collected and measured cumulatively and continuously. The device can be constructed simply and economically from readily available reagents and glassware. Data are given on relative sensitivity and on the effect of the color and transparency of the inner vial. A pilot experiment with bacteria (Escherichia coli) is described. (auth)

32634 RADIOMETRIC METHOD FOR THE DETECTION OF COLIFORM ORGANISMS IN WATER Bachrach, U.; Bachrach, Z. (Hebrew Univ., Jerusalem). Appl. Microbiol.; 28: No. 2, 169-171 (Aug 1974).

Radiometric method for the detection of coliform bacteria in water is described. The method is based on the release of $^{14}CO_2$ from [^{14}C] lactose by bacteria suspended in growth medium and incubated at 37°C. The evolved $^{14}CO_2$ is trapped by hyamine hydroxide and counted in a liquid scintillation spectrometer. The method permits detection of 1 to 10 organisms within 6 h of incubation. Coliform bacteria suspended in water for several days recover from starvation and may be quantitated by the proposed method. Bacteria from water samples may also be concentrated by filtration through membrane filters and detected by the radiometric assay. (auth)

32635 RAPID METHOD FOR THE RADIOISOTOPIC ANALYSIS OF GASEOUS END PRODUCTS OF ANAEROBIC METABOLISM. Nelson, D. R.; Zeikus, J. G. (Univ. of Wisconsin, Madison). Appl. Microbiol.; 28: No. 2, 258-261(Aug 1974).

A gas chromatographic procedure for the simultaneous analysis of ^{14}C-labeled and unlabeled metabolic gases from microbial methanogenic systems is described. H_2, CH_4, and CO_2 were separated within 2.5 min on a Carbosieve B column and were detected by thermal conductivity. Detector effluents were channeled into a gas proportional counter for measurement of radioactivity. This method was more rapid, sensitive, and convenient than gas chromatography-liquid scintillation techniques. The gas chromatography-gas proportional counting procedure was used to characterize the microbial decomposition of organic matter in anaerobic lake sediments and to monitor $^{14}CH_4$ formation from H_2 and $^{14}CO_2$ by Methanosarcina barkeri. (auth)

32636 DETERMINATION OF EFFECTIVE RENAL PLASMA FLOW WITH THE HELP OF HIPPURAN-^{131}I IN THYROID GLAND DISEASES. Ketskarova, S.; Peshev, N. (Central Radioisotope Lab., Sofia). Med. Radiol.; 19: No. 10, 26-28(Oct 1974). (In Russian).

The authors studied the effective renal plasma flow in 52 patients suffering from thyroid gland diseases. In different diseases of the goiter the changes of this index are explained by a change in the blood flow, condition of the cardiovascular system, increase of the thyroid hormones level, and other reasons, and depend upon the form and stage of the disease. Determination of the effective renal plasma flow in combination with radio-isotope methods of the thyroid gland investigation can serve as a stable criterion for the assessment of the form and stage of the disease. (auth)

32637 VISUALIZATION OF PLACENTAL ABRUPTION BY BLOOD POOL SCANNING. Weiss, P. H.; Strong, J. D. (Air Force Medical Center, Wright-Patterson AFB, OH). J. Nucl. Med.; 15: No. 10, 900-901(Oct 1974).

A patient with marginal placental abruption diagnosed by blood pool scanning with ^{99m}Tc-pertechnetate is presented. Scintigraphic findings were different from those reported previously. (auth)

32638 COMPARATIVE STUDY OF ^{125}I- AND [^{3}H]ACETATE-LABELED ANTIBODIES IN DETECTING IRIDESCENT VIRUSES. Bilimoria, S. L.; Parkinson, A. J.; Kalmakoff, J. (Univ. of Otago, Dunedin, N. Z.). Appl. Microbiol.; 28: No. 1, 133-137(Jul 1974).

Radioimmunoassays for detecting cell-associated or released virus are described using either ^{125}I- or [^{3}H]acetate-labeled antibodies. In the first assay system, antigen-antibody complexes were separated from free antibody by centrifugation. Sensitivities of 0.1 μg of iridescent virus could be achieved with either ^{125}I- or [^{3}H]acetate-labeled antibody. In the second assay, the antigen was fixed to cover-slip cell cultures, and then reacted with labeled antibody, unbound radioactivity being removed by repeated washing. Nonspecific binding with this method was 0.5 to 1% of the total radioactivity added and sensitivities of 0.1 or 10 μg were achieved with ^{125}I and [^{3}H]acetate, respectively. Immunoglobulins were labeled at the rate of 1 in 300 for ^{125}I and 1 in 200 with [^{3}H]acetate although there was a 400-fold greater isotopic abundance of ^{125}I relative to ^{3}H. The possibility of preparing labeled protein of high specific activity using carrier-free [2-^{3}H]iodoacetic acid is discussed. (auth)

32639 PHYSIOLOGY OF SPORE FORMING BACTERIA ASSOCIATED WITH INSECTS: RADIORESPIROMETRIC SURVEY OF CARBOHYDRATE METABOLISM IN THE 12 SEROTYPES OF BACILLUS THURINGIENSIS. Nickerson, K. W.; St. Julian, G.; Bulla, L. A. Jr. (Dept. of Agriculture, Peoria, IL). Appl. Microbiol.; 28: No. 1, 129-132(Jul 1974).

Radiorespirometry was used to compare the primary pathways of glucose catabolism in 18 strains of Bacillus thuringiensis representing the 12 established serotypes. Every strain utilizes the Embden-Meyerhof-Parnas pathway almost exclusively; pentose-phosphate pathway participation is minor. The Embden-Meyerhof-Parnas pathway predominates regardless of whether the cells were grown in a minimal medium or one containing yeast extract. The results indicate that the absolute requirement for citrate and related compounds is not a result of defective citrate or glucose transport and metabolism. (auth)

32640 RADIOIMMUNOASSAY OF PLASMA ELASTASE. Carballo, J.; Kasahara, K.; Appert, H. E.; Howard, J. M. (Hahnemann Medical Coll., Philadelphia). Proc. Soc. Exp. Biol. Med.; 146: No. 4, 997-1002(Sep 1974).

A radioimmunoassay system was developed for the measurement of canine elastase. The method is able to measure elastase in plasma in concentrations ranging from 0.1 to 2.0 μg/ml. No cross-reactivity was found with trypsin or chymotrypsin. The elastase levels in canine plasma were measured during experimental pancreatitis. Within 15 min after the induction of pancreatitis, the elastase levels as measured by radioimmunoassay increased to about 2.5 times their control levels. They remained above the control levels throughout the course of the experiment. On the other hand the elastolytic activity decreased after pancreatectomy. (auth)

32641 MEASUREMENT OF RADIOACTIVE PRECURSOR INCORPORATION INTO SMALL MONOLAYER CULTURES. Ball, C. R.; Van den Berg, H. W.; Poynter, R. W. (Medical School, Leeds, Eng.). Methods Cell. Biol.; 7: 349-360(1973).

A straightforward and reproducible technique for measuring incorporation of labeled precursors into nucleic acids and proteins of small monolayer cell cultures is described in detail, together with the background to its development and some illustrations of its use. (auth)

32642 DETECTION OF SMALL BONE ABSCESSES WITH A HIGH-RESOLUTION CADMIUM TELLURIDE PROBE. Garcia, D. A.; Entine, G.; Tow, D. E. (Veterans Administration Hospital, West Roxbury, MA). J. Nucl. Med.; 15: No. 10, 892-895(Oct 1974).

A cadmium telluride (CdTe) semiconductor probe was tested under clinical conditions as an external detector of medium-energy γ rays and its performance was compared with that of the detector system of a rectilinear scanner. The two systems were used to detect acute infectious abscesses in dogs following the administration of ^{99m}Tc-polyphosphate (Tc-PP) tracer. The counting efficiency of the CdTe probe when held in contact with the jaw was 50 to 75% of that obtained with a 5-in. NaI(Tl) crystal detector at a 3-in. focal plane distance from its medium-energy, fine-focus collimator (168 hole). The reproducibility of the CdTe probe measurements of normal teeth fell within a range of ±13%. Diagnostically significant increases in Tc-PP uptake were detected in abscessed teeth with both detector systems within 1 to 2 weeks after infection as compared with intraoral radiography, which required 4 weeks for positive detection. In terms of spatial resolution, the CdTe probe proved to be superior in that it could readily distinguish contiguous normal and infected root tips less than 1 cm apart. In contrast, the NaI detector system was unable to distinguish the normal root tips of an uninfected tooth interposed between those of two adjacent infected teeth. (auth)

32643 CONTINUOUS RADIONUCLIDE GENERATION. II. Scintigraphic Definition of Capillary Exchange by Rapid Decay of ^{81m}Kr and Its Applications. Kaplan, E.; Mayron, L. W.; Barnes, W. E.; Colombetti, L. G.; Friedman, A. M.; Grindler, J. E. (Veterans Administration Hospital, Hines, IL). J. Nucl. Med.; 15: No. 10, 874-879(Oct 1974).

Specific theoretical considerations of the properties of the radionuclide ^{81m}Kr are presented as preliminary to the application of a new method of selective scintigraphic angiography. This technique proposes defining the size, configuration, and location of infarcts; vascular insufficiency; and other physiologic and pathologic sites of absent, increased, or decreased circulatory exchange. An ^{81}Rb-^{81m}Kr radionuclide generator was constructed to produce, at a constant rate, ^{81m}Kr, a water-soluble gas, diffusible through capillary membranes, emitting a monoenergetic γ ray, and decaying with a half-life of 13 sec. This gas in solution may be infused at a constant rate intra-arterially into an organ or anatomic region. Infusion may be sustained until equilibrium conditions prevail. In this steady state intravascular radioactivity remains constant as it is replaced by newly generated ^{81m}Kr. The gas that diffuses into the extracapillary space exchanges more slowly than the intravascular activity. The rapid decay produces a heterogeneity of distribution of radioactivity which depends on the diffusion time. A static image produced by a scintillation camera will detect, record, and display this heterogeneity and may be processed to define the adequacy of capillary exchange. The built-in clock of rapid decay will define the kinetics of exchange in a steady state with a single image. Applications of the ^{81m}Kr generator delivery system are described. (auth)

32644 NOVEL ^{123}I-LABELING REAGENT. XIII. Synthesis and Loading-Dose Effects of ^{123}I-4-Iodophenylalanine and ^{123}I-5- and 6-Iodotryptophan. Lambrecht, R. M.; Atkins, H.; Elias, H.; Fowler, J. S.; Lin, S. S.; Wolf, A. P. (Brookhaven National Lab., Upton, NY). J. Nucl. Med.; 15: No. 10, 863-867(Oct 1974).

A new iodination reagent, the ^{123}I species resulting from the decay of ^{123}Xe, was used in the exchange labeling of iodinated radiopharmaceuticals in the melt. Both ^{123}I-4-iodophenylalanine and ^{123}I-5- and 6-iodotryptophan were labeled by the melt method. A loading-dose effect on the ratio (percent uptake per gram) of pancreas:liver was observed in mice for ^{123}I-4-iodophenylalanine, but not for ^{123}I-6-iodotryptophan. (auth)

32645 ANALOG IMAGE PROCESSING IN TWO DIMENSIONS BY OMNIDIRECTIONAL SCANNING. Nohara, N.; Tomitani, T.; Tanaka, E. (National Inst. of Radiological Sciences, Anagawa, Japan). J. Nucl. Med.; 15: No. 10, 844-847(Oct 1974).

A new method of two-dimensional radionuclide scan image processing by analog techniques is introduced. The original image stored on a film is rescanned by a flying spot scanner with a special raster, so-called omnidirectional scanning, by which the film is scanned in any direction with constant speed and with uniform scan-line density. The extracted image information is fed through an electronic filter to a display CRT. The asymmetric impulse response of the filter can be canceled out by superposition of video signals in all directions on the screen of the CRT. Therefore two-dimensional image processing can be accomplished with the one-dimensional filter. The preliminary processor was constructed and tested for phantom images obtained with a scintillation camera. (auth)

32646 LUXURY-PERFUSION SYNDROME FOLLOWING A CEREBROVASCULAR ACCIDENT DEMONSTRATED BY RADIONUCLIDE ANGIOGRAPHY. Snow, R. M.; Keyes, J. W. Jr. (Univ. of Rochester, NY). J. Nucl. Med.; 15: No. 10, 907-909(Oct 1974).

A radionuclide angiogram done with ^{99m}Tc immediately after the onset of symptoms of a cerebrovascular accident revealed the expected findings of decreased flow on the affected side. However, a repeat study 11 days later showed markedly increased flow in the same area with pronounced uptake also seen on the early static images. By 23 days, the flow pattern and early static images had reverted to normal. This sequence appears to represent a radionuclide demonstration of the luxury-perfusion syndrome and supports the hypothesis that the occurrence of this syndrome in ischemic cerebrovascular disease is a transient, time-dependent phenomenon. Clinicians should be aware that this pattern of increased flow can be compatible with the diagnosis of stroke. (auth)

32647 CLINICAL COMPARISON OF THE KINETICS OF ^{99m}Tc-LABELED POLYPHOSPHATE AND DIPHOSPHONATE. Krishnamurthy, G. T.; Tubis, M.; Endow, J. S.; Singhi, V.; Walsh, C. F.; Blahd, W. H. (Veterans Administration Wadsworth Hospital Center, Los Angeles). J. Nucl. Med.; 15: No. 10, 848-855(Oct 1974).

Kinetics of ^{99m}Tc-labeled polyphosphate and diphosphonate (disodium ethane-1-hydroxy-1, 1-diphosphonate) were studied and compared clinically in ten patients in a paired study. Four hours after injection, both agents show a biexponential type of blood clearance. Exponent I represents bone uptake and Exponent II, mainly the renal excretion. The clearance of diphosphonate was relatively faster than that of polyphosphate resulting in significantly lower blood background radioactivity. Both agents showed identical plasma protein fraction binding and 4-hr urinary excretion. The kidneys were well visualized with both agents, consistently better with polyphosphate. The sensitivity for the detection of lesions is similar for both. At the end of 4 hr, 10% of the dose of ^{99m}Tc-polyphosphate was circulating in the blood, 33.3% was excreted in urine, and the remaining 56.3% was taken up by bone and other tissues. It was concluded that both ^{99m}Tc-labeled polyphosphate and diphosphonate are excellent skeletal-imaging agents and have equal sensitivity. No toxic reactions were noted with either agent. (auth)

32648 COMPARISON OF ^{99m}Tc-POLYPHOSPHATE AND ^{18}F. II. Imaging. Krishnamurthy, G. T.; Walsh, C. F.; Shoop, L. E.; Berger, H. G.; Blahd, W. H. (Veterans Administration Wadsworth Hospital Center, Los Angeles). J. Nucl. Med.; 15: No. 10, 837-843(Oct 1974).

Comparison was made between ^{99m}Tc-polyphosphate (Tc-PP) and ^{18}F in clinical imaging studies. The normal skeletal structure was better delineated with Tc-PP than with ^{18}F. The sternum, sternoclavicular joint, iliac crests, and inferior angle of the scapulas appear more prominently with Tc-PP. The degree of renal concentration of Tc-PP seems to have good correlation with renal parenchymal function and poor correlation with ^{18}F. In men, the scrotum and penis normally concentrate Tc-PP more avidly than ^{18}F and so may contribute to a false-positive pelvic bone scan. Bone lesions are better delineated with Tc-PP than with ^{18}F. A few lesions not seen with ^{18}F are clearly delineated with Tc-PP. With Tc-PP, scintillation camera images are superior to rectilinear scans. In the scintillation camera, high-resolution collimator images are superior to high-sensitivity collimator images. Even though study time with the high-resoluton collimator is relatively longer than that with the high-sensitivity collimator, the superior resolution of the high-resolution collimator more than compensates for its longer study time. It is concluded that the best skeletal images are obtained with Tc-PP and a scintillation camera equipped with a high-resolution collimator. (auth)

32649 ABNORMAL BRAIN SCAN IN PAGET'S DISEASE OF BONE - CONFUSION WITH SUBDURAL HEMATOMA. Preimesberger, K. F.; Loken, M. K.; Shafer, R. B. (Veterans Administration Hospital, Minneapolis). J. Nucl. Med.; 15: No. 10, 880-883(Oct 1974).

Static brain images utilizing ^{99m}Tc-pertechnetate were performed on two patients with the clinical impression of subdural hematoma. In each the brain scan was compatible with that diagnosis. Skull radiographs and soft-tissue x-rays were normal. Cerebral arteriograms were also normal. Bone images with ^{99m}Tc-pyrophosphate in conjunction with a clinical re-evaluation and persistent elevation of the serum alkaline phosphatase permitted the correct diagnosis of Paget's disease of bone. (auth)

32650 HEPATIC CAVERNOUS HEMANGIOMA PRESENTING AS AN AVASCULAR MASS IN A NEWBORN. Beal, W.; Soin, J. S.; Burdine, J. A. (Baylor Coll. of Medicine, Houston, TX). J. Nucl. Med.; 15: No. 10, 902-903(Oct 1974).

A case of hepatic cavernous hemangioma complicated by bleeding in a 1-day-old child is presented. Radionuclide images suggest that bleeding hemangioma may be present as an avascular mass in the liver. (auth)

32651 METABOLISM OF [4-^{14}C] CHOLESTEROL BY HUMAN ADRENAL GLANDS IN VITRO AND ITS INHIBITION BY METYRAPONE. Carballeira, A. (Univ. of Miami, FL); Cheng, S. C.; Fishman, L. M. Acta Endocrinol.; 76: 689-702(1974).

The in vitro conversion of [4-^{14}C] cholesterol to steroid hormones was studied in 1 normal, 1 adenomatous, and 2 hyperplastic, surgically resected, human adrenals. The degree of overall conversion per gram of tissue was similar (4.4-5.6%) in NADPH-supplemented homogenates from normal or moderately hyperactive adrenals; a 2-fold increase was found in a markedly hyperfunctioning gland. (auth)

32652 CONTROL OF CADMIUM BINDING PROTEIN SYNTHESIS IN RAT LIVER. Squibb, K. S.; Cousins, R. J. (Rutgers - The State Univ., New Brunswick, NJ). Environ. Physiol. Biochem.; 4: 24-30(1974).

The synthesis of a cadmium binding protein in rat liver was measured using a double label-liquid scintillation technique wherein ^{3}H-cystine incorporation was used as an index of protein synthesis and ^{115m}Cd was used to quantitate cadmium binding after the soluble hepatic proteins were fractionated by gel filtration chromatography. Injections of 4.5 μmoles of Cd^{+2} plus 0.27 nmoles of ^{115m}Cd markedly increased the incorporation of ^{3}H-cystine into a specific low molecular weight cadmium binding protein and also substantially increased the total Cd bound to this protein. When only 0.27 nmoles of Cd^{+2} (as ^{115m}Cd) was administered, ^{3}H-cystine was not incorporated into the CdBP but small amounts of Cd^{+2} were bound to the CdBP. Blocking protein synthesis with cycloheximide nearly abolished the incorporation of ^{3}H-cystine into CdBP following administration of 4.5 μmoles of Cd^{+2} plus 0.27 nmoles of Cd^{+2} as ^{115m}Cd and in addition decreased the Cd^{+2} content of the CdBP but substantially increased the Cd^{+2} content of the higher molecular weight proteins. Actinomycin D also blocked the incorporation of ^{3}H-cystine and Cd^{+2} into CdBP when administered prior to administration of 4.5 μmoles Cd^{+2} and 0.27 nmoles ^{115m}Cd and concomitantly increased the amount of Cd^{+2} bound to the higher molecular weight proteins. When actinomycin D was administered 3 hours after both Cd^{+2} injections, the antibiotic was unable to inhibit the formation of CdBP. These data suggest that cadmium stimulates the de novo synthesis of a cadmium binding protein probably via an event that involves formation of a specific mRNA. (auth)

32653 RADIONUCLIDE DIAGNOSIS IN CHEST DISEASE RESULTING FROM TRAUMA. Milstein, D.; Nusynowitz, M. L.; Lull, R. J. (Army Medical Center, El Paso, TX). Semin. Nucl. Med.; 4: No. 4, 339-355(Oct 1974).

Nuclear medicine procedures can be used effectively to assess abnormalities of the chest following thoracic or nonthoracic trauma. The most significant applications include studies of ventilation and perfusion in blunt chest trauma and burns, thromboembolism, and fat embolism syndrome. The evaluation of subtle fractures, pleural and pericardial fluid collections, mediastinal masses, and radiation damage by radionuclidic techniques is also useful. Considerable research will be required to ultimately define the role of nuclear medical procedures in the diagnosis of thoracic abnormalities in trauma. (auth)

32654 TRAUMA TO THE BRAIN AND EXTRACRANIAL STRUCTURES. Cowan, R. J.; Maynard, C. D. (Wake Forest Univ., Winston-Salem, NC). Semin. Nucl. Med.; 4: No. 4, 319-338(Oct 1974).

Over the past 10 years there have been numerous reports in the literature on the value and limitations of the various radionuclide procedures in the investigation of patients following head trauma. This review contains an amalgamation of the currently known information concerning the usefulness of these procedures in the different clinical entities that may result from trauma to the brain and extracranial structures. The intravenous cerebral dynamic study and the static brain image have successfully been employed in the diagnosis of patients with subdural hematomas, epidural hematomas, intracerebral hematomas, and contusions of the brain. Properly employed, these studies may be utilized as screening procedures, and in isolated incidences may provide the definitive diagnosis. The problems associated with positive static images as a result of skull and scalp trauma will also be considered. Radioisotope cisternography has also been found to be of clinical value in the localization of cerebrospinal fluid leaks resulting from trauma and in the evaluation of disturbed CSF flow following head injuries. (auth)

32655 RADIONUCLIDE IMAGING OF OSSEOUS TRAUMA. Fordham, E. W.; Ramachandran, P. C. (Rush Univ., Chicago). Semin. Nucl. Med.; 4: No. 4, 411-429(Oct 1974).

Radionuclide imaging in osseous trauma is now possible with the availability of low-radiation-dose bone-localizing agents. Bone trauma results in increased uptake of activity at the traumatic site by the 3rd day. Maximum uptake occurs at 3 to 5 weeks and may resolve over a variable time. Increased uptake at the site of a fracture may persist for many years. Osseous imaging has proved useful in neurologic problems, circulatory disease, aseptic necrosis, direct bone trauma, stress, iatrogenic trauma, and radiation injury. The agents of choice currently are ^{18}F and the bone-localizing compounds of ^{99m}Tc. (auth)

32656 INTRAVENOUS RADIONUCLIDE ANGIOGRAPHY IN THE DIAGNOSIS OF TRAUMA. Rosenthall, L. (Montreal General Hospital). Semin. Nucl. Med.; 4: No. 4, 395-409(Oct 1974).

Radionuclide diagnosis of trauma to organs usually incorporates a target-specific radiopharmaceutical and static imaging in multiple projections. Intravenous radionuclide angiography as an adjunct to static organ imaging is generally not helpful, but on occasion some useful additional information may be derived. Investigation of the large arteries and veins by intravenous radionuclide angiography, on the other hand, is a fairly accurate and innocuous modality for disclosing the results of trauma to the major vessels. This review attempts to show by a series of case reports the scope and kind of information that might be obtained. (auth)

32657 RADIONUCLIDE STUDIES AFTER URINARY-TRACT INJURY. Berg, B. C. Jr. (Univ. of Illinois, Peoria). Semin. Nucl. Med.; 4: No. 4, 371-393(Oct 1974).

Imaging studies, utilizing the dynamic and static capabilities of the scintillation camera, are uniquely suited to the need for rapid, noninvasive, reliable examination of the traumatized patient. Non-penetrating thoracoabdominal trauma may well inflict hepatic, splenic, or renal injury that is life-threatening. The most commonly employed radionuclide compound for the study of acute renal injury at this time probably is ^{99m}Tc-labeled DTPA (or ^{99m}Tc-Fe-ascorbic acid). The advantages of the ^{99m}Tc label, in combination with ^{99m}Tc-sulfur colloid and/or ^{99m}Tc-albumin microspheres for additional, simultaneous, or sequential diagnostic procedures, are readily apparent. The efficiency and versatility of the gamma camera, as the instrument of choice in the examination of the traumatized patient, has revolutionized the diagnostic-treatment protocol for the patient suffering from thoracoabdominal trauma. Not only the fact of trauma, but the extent of trauma, whether involving the kidneys, renal vascular supply, and/or renal bed, as well as the entire upper urinary tract and urinary bladder, can now be determined with a high degree of accuracy. Associated hepatosplenic injury can be determined as well. Quickly, safely, and with ease, those patients who may require more definitive radiographic techniques or surgery may be identified. The imaging techniques should be available at the community hospital level by those regional hospitals equipped and staffed for the emergency care of the traumatized patient. (auth)

32658 MEASUREMENT OF GROWTH AND RATES OF INCORPORATION OF RADIOACTIVE PRECURSORS INTO MACROMOLECULES OF CULTURED CELLS. Everhart, L. P.; Hauschka, P. V.; Prescott, D. M. (Univ. of Colorado, Boulder). Methods Cell. Biol.; 7: 329-347(1973).

Growth conditions are described for cultures of Chinese hamster ovary cells. Thymidine, leucine, and uridine were labeled with ^{3}H and ^{14}C for studies on synthesis of DNA, RNA, and proteins. Methods for measuring precursor incorporation are described and graphs are presented to show results. Linear incorporation of ^{3}H-thymidine into DNA continued for the course of the experiment, about 60 min. Similar results were obtained for incorporation of ^{3}H-uridine into RNA. Linear incorporation of ^{3}H-leucine into proteins continued for 2.5 hr. Problems involved in interpretation of results included purity of precursors, uptake, pools, metabolism, and counting efficiency. (HLW)

MATERIALS

32659 (CONF-721228-) PROCEEDINGS OF THE SYMPOSIUM ON ELECTRICAL, ELECTRONIC, AND MAGNETIC MATERIALS, MADRAS, INDIA, DECEMBER 7–9, 1972. (Department of Atomic Energy, Bombay (India). Chemistry and Metallurgy Committee). 1972. 581p.

A separate abstract was prepared for 1 of the 42 papers presented. The remaining 41 papers were not within the scope of NSA. (WHK)

For an abstract of an individual paper see: 33069.

32660 DIFFUSION COEFFICIENTS IN CHANNELING. Waho, T.; Ohtsuki, Y. H. (Waseda Univ., Tokyo). Radiat. Eff.; 21: No. 4, 217-219(1974).

Making use of the general formula introduced by Ohtsuki (J. Phys. Soc. Jap.; 34: 473(1973)), detailed calculations for diffusion coefficients in channeling are performed. The nuclear and single electron excitations are considered separately compared with the plasmon excitation. Analytic expressions proposed in a previous paper (Kitagawa, et al., Phys. Rev.; B1: (1973) in press) are confirmed. (auth)

32661 CALCULATIONS ON THE EFFECTS OF A PINNING ON DISLOCATION MOTION. Mizubayashi, H.; Okuda, S. (Japan Atomic Energy Research Inst., Tokai). Radiat. Eff.; 21: No. 3, 185-191(Mar 1974).

The effect of a pinning of dislocation on the internal friction and modulus defect is discussed for the two types of interaction between dislocation and point defect, the one being the interaction with viscous dragging force (the defect dragging model by Simpson and Sosin [Phys. Rev.; B5: 1382 (1972)]) and the other the interaction with elastic restoring force. The mode of a dislocation motion when a pinning occurs at a center of a dislocation loop is examined and the anomaly in the change in the modulus defect in these models is discussed. (auth)

32662 SYMPOSIUM ON THERMAL ANALYSIS. Proceedings of the 2nd Nordic Symposium, Risoe, Denmark, September 13–14, 1973. Stockholm; Scandinavian Council for Applied Research (1973). 212p. (CONF-7309114-).

From 2nd Nordic symposium on thermal analysis; Riso, Denmark (13 Sep 1973).

Eighteen papers were presented at the symposium. A separate abstract was prepared for each of two papers selected by NSA scope. (JRD)

For abstracts of individual papers see: 32731 and 32838.

Ceramics and Cermets

Refer also to abstracts 31584, 31588, 32767, 32840, 32845, 32863, 32865, 32929, 34163, 34164, 34181, 34185–34187, 34190, 34191, 34232, 34245, 34284, and 34386.

32663 (AD-777068) CERAMIC PROCESSING STUDIES IN $MgAl_2O_4$ SYSTEM. Final Technical Report, 18 February 1971–18 December 1973. Jorgensen, P. J. (Stanford Research Inst., Menlo Park, Calif. (USA)). Jan 1974. Contract N00019-71-C-0246. 42p. (SRI-PYU-1123-FR). NTIS $3.25.

The final-stage sintering behavior or densification of $MgAl_2O_4$ has been studied as a function of stoichiometry in an attempt to inhibit grain growth by solute segregation to the grain boundaries and to allow spinel to sinter to theoretical density. It was found that the grain growth could be inhibited by deviations from stoichiometry, and that grain growth inhibition increased as the spinel composition approached the solid solubility limit in MgO-rich spinel. Changes in stoichiometry do not provide sufficient grain growth inhibition to prevent the occurrence of discontinuous grain growth. However, spinel can be sintered to theoretical density by a second-phase mechanism in which the second phase is MgO. The presence of the second phase in the spinel causes light scattering and results in a translucent material. (GRA)

32664 (AD-778447) HIGH TEMPERATURE ELECTRICAL AND THERMOPHYSICAL PROPERTIES OF CERAMIC MATERIALS. Final Report, September 1971–July 1973. Wimmer, J. M. (Aerospace Research Labs., Wright-Patterson AFB, Ohio (USA)). Mar 1974. 8p. (ARL-74-0019). NTIS $3.00.

The investigation centered on three topics: techniques to determine the electrical conductivity of insulators above 1500°C; charge transport in ceria–zirconia solid solutions; and vaporization kinetics of strontium doped lanthanum chromite. Interest in the latter two materials was related to their potential use as high temperature electrodes for magnetohydrodynamic generators. The major accomplishments are summarized. (GRA)

32665 (ANL/CEN/AF-100) BIBLIOGRAPHY OF PROPERTIES DATA ON ACTINIDE CARBIDES AND NITRIDES. Sheth, A.; Gabelnick, S. D.; Foster, M. S.; Chasanov, M. G.; Johnson, C. E. (Argonne National Lab., Ill. (USA)). Sep 1974. Contract W-31-109-Eng-38. 330p. Dep. NTIS $19.50.

The national advanced fuels program requires chemical, mechanical, and thermophysical properties of potential fast reactor fuel candidates. Properties data are given for carbides, nitrides, carbonitrides, oxycarbides, and oxynitrides of uranium and plutonium and mixed uranium and plutonium compounds. In all, 39 different properties are given for 25 different compounds and supported by 743 literature abstracts. (auth)

32666 (CONF-740905-3) APPLICATION OF A METHOD OF FREQUENCY MODULATION MOESSBAUER SPECTROSCOPY IN ^{67}Zn TO THE PRECISE DETERMINATION OF THE ELECTRIC QUADRUPOLE INTERACTION OF ^{67}ZnO. Perlow, G. J.; Potzel, W.; Kash, R. M.; DeWaard, H. (Argonne National Lab., Ill. (USA)). 1974. 19p. Dep. NTIS $4.00.

From international conference on the applications of the Mossbauer effect; Bendor, France (2 Sep 1974).

A source containing ^{67}Ga in a ZnO single crystal was mechanically oscillated with varying frequency by a quartz crystal. The resulting f-m sidebands of the 93.26-keV γ-ray were thereby swept across the absorption lines of a ZnO absorber. The frequency separations of the ground state triplet are measured to be $\nu_1 = 361.2 \pm 1.0$ kHz and $\nu_2 = 723 \pm 4$ kHz. The quadrupole coupling is $e^2qQ = 2.408 \pm 0.006$ MHz, and the asymmetry parameter is $\eta = 0.00\ \{^{+0.065}_{-0}\}$. All measurements were made at 4.2°K. (6 figs.) (auth)

32667 (EURFNR-1140) STUDIES ON THE MECHANICAL CHARACTERISTICS OF CYLINDRICAL REACTOR FUEL PINS. Lassmann, K. (Kernforschungszentrum Karlsruhe (F. R. Germany)). Nov 1973. Translation of KFK-1853. 136p. Dep. NTIS $10.00.

Work performed under United States–Euratom Fast Reactor Exchange Program.

Results are presented on the mechanical behavior of cylindrical fuel pins used in the majority of power reactors. Information and discussions are included on physical and technological phenomena in fuel pin burnup, fuel rod mechanics for rotational symmetry, creep, effects of fins on creep, and creep buckling. (JRD)

32668 (KFK-2008) THE COATING OF UO_2-PELLETS WITH NIOBIUM-METAL. Schneider, H.; Nold, E. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Jun 1974. 12p. (In German). INIS.

6 figs.; 1 tab.; 7 refs. With abstract in German and English.

A coating procedure for UO_2-pellets with metallic niobium is described. The coated pellets will be used as oxygen getter for compatibility tests. The reaction underlying the coating procedure is: $2\ NbCl_5 + 5H_2 = 2\ Nb + 1\ OHCl$. The procedure was carried out in a rotating quartz tube at a temperature of about 800°C. The apparatus used and the experimental setup are described. The pellets coated under these conditions showed dense adherent and uniform layers of niobium metal of 25 to 30 ωm thickness. The chloride-content of the coated pellets was below 30 ppM. (auth)

32669 (KFK-EXT-6/74-2, pp 1-7) PREPARATION AND HARDNESS OF TaC–HfC MIXED PHASES. Scholz, B. Apr 1974. (In German).

6 figs.

In structure, preparation and properties of refractory compounds and systems (nard materials and hard metals) (research project 0F80). Second semiannual report 1973.

Specimens were prepared by powder-metallurgical methods (by hot pressing) or by melting. The Vickers hardness was measured at TaC, HfC, and TaC–HfC mixed phases as functions of the C content, the relation TaC/HfC, and the temperature. With the transition from low-carbon carbides to the stoichiometric carbides (50 at. % C), the hardness increases in all cases–with

the exception of pure HfC. The hardness of the mixed phases in all cases is higher than that of pure TaC and HfC. (GE)

32670 (KFK-EXT-6/74-2, pp 8-24) THE INFLUENCE OF DISSOLVED MoC_{1-x} AND WC_{1-x} ON THE HARDNESS OF TRANSITION-METAL CARBIDES. Holleck, H.; Biemueller, K.; Janzer, H.; Schlickeiser, G. Apr 1974. (In German).

11 figs.; 1 tab.; 4 refs.

In structure, preparation and properties of refractory compounds and systems (hard materials and hard metals) (research project 0F80). Second semiannual report 1973.

While the carbides of the IVA transition-metals possess a maximum hardness with stoichiometric compositions, carbides of the VA metals Nb and Ta have a maximum hardness in the substoichiometric region $NbC_{0.8}$, $Ta_{0.8}$. With mixed carbides between TiC, ZrC and HfC with MoC_{1-x} or WC_{1-x}, the hardness-reducing effect of the increasing substoichiometry is partly overcompensated for by an increase in hardness due to the part replacement of Ti, Zr, and Hf by Mo and W. The remarkable increase in hardness (starting from the stoichiometric carbides) for the mixed carbides between VC, NbC, and TaC with MoC_{1-x} or WC_{1-x} is mainly due to the increasing substoichiometry of the carbides. (GE)

32671 (KFK-EXT-6/74-2, pp 25-36) PREPARATION AND PROPERTIES OF MIXED-PHASE HARD MATERIALS FROM TaC WITH MoC_{1-x} AND WC_{1-x}. Holleck, H.; Biemueller, K.; Janzer, H. Apr 1974. (In German).

12 figs.; 2 refs.

In structure, preparation and properties of refractory compounds and systems (hard materials and hard metals) (research project 0F80). Second semiannual report 1973.

The complicated preparation of the purest possible ternary samples by hot pressing and partly remelting is described. The hardness of the ternary carbides goes well above the maximum hardness value of the binary system Ta–C. The properties of substoichiometric ternary carbides depend greatly on the distribution of the carbon in the lattice. (GE)

32672 (KFK-EXT-6/74-2, pp 37-43) CHEMICAL REACTIONS OF Ta–Hf CARBONITRIDES WITH POTENTIAL BINDER METALS. Komac, M. Apr 1974. (In German).

3 figs.; 5 tabs.

In structure, preparation and properties of refractory compounds and systems (hard materials and hard metals) (research project 0F80). Second semiannual report 1973.

Phase investigations have been carried out on combinations of various tantalum and hafnium carbonitrides with different binder metals (Co, Ni, $NiMo_{30}$). Numerous reaction products were obtained at temperatures of 1,400°C and over, however, not all carbonitrides reacted. (GE)

32673 (KFK-EXT-6/74-2, pp 44-47) ON THE THERMODYNAMICS OF HARD MATERIAL-BINDER REACTIONS. Kleykamp, H. Apr 1974. (In German).

In structure, preparation and properties of refractory compounds and systems (hard materials and hard metals) (research project 0F80). Second semiannual report 1973.

The value of the carbon activity at which no reaction takes place between hard material and binder metal is calculated. Therewith, the stoichiometry of the hard material which represents the boundary between a stable and unstable system is characterized. This is explained by means of two typical examples of hard material–metal combinations: the ternary systems Ti–C–Ru and Ti–C–Cr, which are distinguished by the formation of an intermetallic phase or of carbides of the binder metal. (GE)

32674 (KFK-EXT-6/74-2, pp 47-47) PREPARATION OF HAFNIUM CARBONIDES. Parameter Studies for the Reaction Pressure Sintering of Powder Mixtures. Brundiers, G. Apr 1974. (In German).

7 figs.; 1 tab.; 4 refs.

In structure, preparation and properties of refractory compounds and systems (hard materials and hard metals) (research project 0F80). Second semiannual report 1973.

All substoichiometric as well as stoichiometric Hf carbonitrides attained an almost complete compression by applying the press sintering method. (GE)

32675 (KFK-EXT-6/74-2, pp 58-64) LINEAR THERMAL EXPANSION OF HAFNIUM CARBONITRIDES. Politis, C.; Brundiers, G. Apr 1974. (In German).

9 figs.; 6 refs.

In structure, preparation and properties of refractory compounds and systems (hard materials and hard metals) (research project 0F80). Second semiannual report 1973.

The temperature dependence of the lattice constants of hafnium carbonitride was measured between 298 and 2,260°K from which the linear thermal expansion was calculated. (GE)

32676 (KFK-EXT-6/74-2, pp 65-67) INDICATIONS ON THE PREPARATION OF HARD MATERIAL SAMPLES FOR CHEMICAL ANALYTICAL STUDIES. Schneider, H.; Nold, E.; Gruenhaeuser, M.; Lessle, E. Apr 1974. (In German).

In structure, preparation and properties of refractory compounds and systems (hard materials and hard metals) (research project 0F80). Second semiannual report 1973.

The result of the chemical analysis can easily be falsified by the preparation of the samples. Thus the oxygen content of pulverized hard material the mortar is made of. The presence of air can also cause the pulverized material to take up oxygen. By grinding in an added protective liquid decalin to prevent oxidation, a higher value of C content may be simulated if the material is not washed with a readily volatile solvent afterwards. (GE)

32677 (N-74-20793) HIGH-TEMPERATURE MASS SPECTROMETRY: VAPORIZATION OF GROUP 4-B METAL CARBIDES. Stearns, C. A.; Kohl, F. J. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Apr 1974. 58p. (NASA-TN-D-7613; E-7510). NTIS $3.75.

The high temperature vaporization of the metal-carbon systems TiC, ZrC, HfC, and ThC was studied by the Knudsen effusion–mass spectrometric method. For each system the metal dicarbide and tetracarbide molecular species were identified in the gas phase. Relative ion currents of the carbides and metals were measured as a function of temperature. Second- and third-law methods were used to determine enthalpies. Maximum values were established for the dissociation energies of the metal monocarbide molecules TiC, ZrC, HfC, and ThC. Thermodynamic functions used in the calculations are discussed in terms of assumed molecular structures and electronic contributions to the partition functions. The trends shown by the dissociation energies of the carbides of Group 4B are compared with those of neighboring groups and discussed in relation to the corresponding oxides and chemical bonding. The high temperature molecular beam inlet system and double focusing mass spectrometer are described. (STAR)

32678 (ZFK–267) CALCULATION AND EXPERIMENTAL TESTING OF THE PHASE DIAGRAMS OF THE U–F–O–H SYSTEM. Gruenberg, H. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Feb 1974. 37p. (In German). Dep. NTIS (US Sales Only) $5.00.

In the heterogeneous system U-O-H, constitution diagrams have been calculated and experimentally checked at a pressure of reacting gases of 1 atm and recommendations for their application are made. Similar work was done for the systems U-F-H, U-F-O, and U-F-O-H. (DLC)

32679 CONCENTRATION REGION OF CUBIC ZIRCONIUM OXYCARBIDE (NaCl TYPE) STABILITY AT 1700°C. Zainulin, Yu. G. (Inst. of Chemistry, Sverdlovsk, USSR). Tr. Inst. Khim., Ural. Nauch. Tsentr, Akad. Nauk SSSR; No. 25, 26-32(1973). (In Russian).

The concentration range of the one-phase existence of cubic (NaCl type) zirconium oxycarbide at 1700°C and 10^{-4} mm Hg is unknown and is adjacent to the Zr–C side of the triangular composition Zr–C–O, but the oxycarbide of the composition $ZrC_{0.67}O_{0.38}$ is characterized by the maximum concentration of oxygen. For ZrC_xO_y phase the lattice parameters increase with increase of the concentration of oxygen and carbon at constant x and y and also during replacement of the carbon atoms with oxygen atoms. This is explained by the uniqueness of the structure of the elementary cell of ZrC_xO_y connected with the presence in the metal and non-metal sublattices of unoccupied nodes (vacancies), whose concentration decreases with increase of the oxygen concentration. (tr-auth)

32680 SUPEREXCHANGE INTERACTION IN THE RARE EARTH INSULATORS. Sidorov, A. A.; Falkovskaya, L. D. (Moscow State Univ.). Int. J. Magn.; 4: No. 2, 125-129(1973).

The superexchange interaction in the rare earth insulators is investigated taking into consideration the many-electronic structure of ions forming the crystal. Using the method of second quantization and the technique of double tensorial operators, the Hamiltonian of the superexchange interaction is presented in the effective form of interaction of the total moments of the magnetic ions. The obtained Hamiltonian is then employed in order to explain the experimental dependence of the Neel and the paramagnetic Curie temperatures of the rare earth pnictides upon the number of the rare earth element. (auth)

32681 ANOMALOUS DEBYE–WALLER FACTOR OF HYDROGEN IN NIOBIUM AS DETERMINED BY QUASIELASTIC NEUTRON SCATTERING. Wakabayashi, N.; Alefeld, B.; Kehr, K. W.; Springer, T. (Kernforschungsanlage, Juelich, Ger.). Solid State Commun.; 15: No. 3, 503-506(1 Aug 1974).

The integrated intensity of quasielastic neutron scattering by protons in polycrystalline $NbH_{0.16}$ and in a single crystal of $NbH_{0.045}$ was investigated as a function of the scattering vector Q. Strong deviations from a harmonic Debye–Waller factor behavior were observed at elevated temperatures. The results show a temperature dependent delocalization of the proton extending as far as the neighboring sites of the interstitial lattice. Experiments on the single crystal indicate a directional dependent mean-square amplitude of the proton even at room temperature. (auth)

32682 PHASE COMPOSITION OF INTERACTION PRODUCTS OF V_2O_3 WITH Ti, Nb, AND Ta OXIDES. Shveikin, G. P.; Alyamovskii, S. I.; Perelyaev, V. A.; Zainulin, Yu. G. (Inst. of Chemistry, Sverdlovsk, USSR). Tr. Inst. Khim., Ural. Nauch. Tsentr, Akad. Nauk SSSR; No. 25, 3-7(1973). (In Russian).

Possible formation at 1600°C in a vacuum of solid solution with corundum-type structure through the quasibinary section V_2O_3–Me_2O_3 and Ti_2O_3, where Me is Nb and Ta, was examined. X radiography showed that in spite of the similarity of the chemical bonds of V_2O_3 and Ti_2O_3, having complete mutual solubility, their interaction with Nb_2O_3 and Ta_2O_3 is different. Whereas V_2O_3 can dissolve significant quantities of Nb_2O_3 (~40 mol. %) and Ta_2O_3 (~20 mol. %), Ti_2O_3 practically does not interact with them. Results make it possible to refine knowledge on the phase components of the (V, Ti, Nb, Ta)–O systems which are non-multiple for the composition regions studied. (tr-auth)

32683 CONNECTION OF CERTAIN V_2O_5 PROPERTIES WITH ITS STRUCTURE. Kasimov, G. G.; Krylov, E. I.; Makurin, Yu. N. (Inst. of Chemistry, Sverdlovsk, USSR). Tr. Inst. Khim., Ural. Nauch. Tsentr, Akad. Nauk SSSR; No. 25, 75-76(1973). (In Russian).

On the basis of energy level schemes, the properties of V_2O_5 were examined. The highest charge V(V) is compensated by the presence of double V–O bonds. The basic physical and chemical properties of pure V_2O_5 are determined by the presence of V–O bonds. The existence of vanadium bronze and low stability V_2O_5 is explained by the nearness of the 3d level of V and the $2p_n$ level of oxygen. (tr-auth)

32684 MAGNETIC SUSCEPTIBILITY OF V_2O_3, Ti_2O_3, AND THEIR SOLID SOLUTIONS IN THE 20 TO 600°C RANGE. Perelyaev, V. A.; Shveikin, G. P. (Inst. of Chemistry, Sverdlovsk, USSR). Tr. Inst. Khim., Ural. Nauch. Tsentr, Akad. Nauk SSSR; No. 25, 13-14(1973). (In Russian).

A study was made of the magnetic susceptibility of the oxides Ti_2O_3 and V_2O_3 and their solid solutions in the 20 to 600°C temperature range. With an increase of the concentration of Ti_2O_3 in the solid solution a decrease of the temperature-independent range of magnetic susceptibility occurs and its displacement to lower temperatures. At concentration of Ti_2O_3 of 10 to 90 mol. % the high-temperature conversion, characteristic for V_2O_3, completely disappears. The effective Bohr moment and the Weiss constant for V_2O_3 and solid solutions of different composition were calculated. (tr-auth)

32685 HOLE CENTRES IN PROTON IRRADIATED CaO AND SrO. Tench, A. J.; Duck, M. J. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Solid State Commun.; 15: No. 2, 333-335(15 Jul 1974).

Isolated V^- centers with $g_\perp$ values of 2.0672 and 2.0667 are observed after proton irradiation of CaO and SrO. The behavior of these centers after thermal and γ-irradiation treatment of the sample indicates that a vacancy aggregate or complex is present after proton irradiation. The V_{OH} center is formed at a higher temperature consistent with the hypothesis that the original proton reacts to form a hydroxyl group. (auth)

32686 ELECTRONIC ENERGY BANDSTRUCTURE OF EuO. Tewari, S. (Indian Inst. of Tech., Kanpur). Solid State Commun.; 15: No. 2, 387-389(15 Jul 1974).

The bandstructure of neutral EuO has been studied using the Augmented Plane Wave Method. The energy eigenvalues E(k) are computed for the equivalent of 2048 points in the Brillouin zone for an energy range appropriate to cover the non metal 2s and 2p and the Eu 4d and 6s states. (auth)

32687 EVIDENCE FOR LOW TEMPERATURE REORIENTATION OF V CENTERS IN MgO FROM ELECTRON–ELECTRON DOUBLE RESONANCE AND UNIAXIAL-STRESS STUDIES. Rius, G.; Herve, A. (CEN, Grenoble, France). Solid State Commun.; 15: No. 2, 421-424(15 Jul 1974).

Results of uniaxial-stress experiments have shown that the V_I and V_{LI} trapped hole centers in MgO reorient at low temperatures. The jump time has been determined by pulsed ELDOR which appears to be a useful technique for studying this kind of molecular motion in solids. (auth)

32688 RECRYSTALLIZATION OF SiC THIN FILMS. Dubey, M.; Singh, G. (Banaras Hindu Univ., India). J. Phys., D (London); 7: No. 11, 1482-1484(21 Jul 1974).

Thin films of SiC have been prepared by electron-beam evaporation. By being pulse-annealed in the electron microscope, as-deposited noncrystalline films recrystallize and grow, first in polycrystalline 2H and 3C phases and subsequently into syntactic 2H and 3C single crystals. (auth)

32689 IMPULSE GENERATION IN SOLID AND POWDERED ALUMINA INDUCED BY A PULSED ELECTRON BEAM. McMordie, J. A. (United Kingdom Atomic Energy Authority, Aldermaston, Eng.). J. Phys., D (London); 7: No. 11, 1500-1511(21 Jul 1974).

Energies of up to 4 kJ g^{-1} were deposited in alumina solids and powders of different porosities by means of a pulsed electron beam with a duration of 80 ns. The impulse generated by these samples was determined by photographically observing the recoiling sample holder. This impulse was generally greater for the solids than the powders. Increasing porosity resulted in decreasing impulse for the solids, as expected on a pressure relief model. The opposite effect was observed with powders. This is attributed to the fact that the more porous powders were comprised of smaller particles which have a higher ultimate compressive strength. (auth)

32690 NEUTRON AND MOESSBAUER STUDY OF THE MAGNETIC ORDERING IN NpP. Lander, G. H.; Dunlap, B. D.; Mueller, M. H.; Nowik, I.; Reddy, J. F. (Argonne National Lab., IL). Int. J. Magn.; 4: No. 2, 99-104(1973).

Neptunium phosphide has the NaCl-type crystal structure with a lattice parameter of 5.614 Å. The compound orders antiferromagnetically at ≃130°K. The magnetic structure is a longitudinal-wave modulation, in which the moments are arranged in ferromagnetic sheets with the spin direction perpendicular to the sheets, and parallel to the propagation direction of the modulation. Between 130 and 74°K the repeat distance is 2.78 ± 0.08 unit cells, and the modulation of the moment from layer to layer is sinusoidal. Below 74°K the magnetic structure is commensurate with the lattice, with a repeat distance of three unit cells. The appearance of a third harmonic at low temperatures indicates a tendency towards forming a square-wave (3+, 3-) configuration, but this process is not complete at 5°K. The Moessbauer spectra at 5°K can be explained by assuming two different hyperfine fields of 3690 ± 50 kOe and 4210 ± 50 kOe at the Np site, with an occupation ratio of two to one. A unique model for the magnetic moments is deduced by using the results from both neutron and Moessbauer experiments. The ordered moments at 5°K are 2.3 ± 0.1 and 1.8 ± 0.1 μ_B/Np. (auth)

32691 ELECTRICAL RESISTIVITY OF TRANSFORMING AND NON-TRANSFORMING V_3Si. Taub, H.; Williams, S. J. (New York Univ.). Solid State Commun.; 15: No. 2, 181-184 (15 Jul 1974).

The electrical resistivity of a non-transforming single crystal of V_3Si is compared with that of a single crystal which exhibits a Martensitic transformation at T_M = 20.2°K. Above T_M, for $24 \leq T \leq 50$°K, the temperature dependent part of the resistivity $\rho(T) - \rho(17.5°K)$ is found to be the same in the two samples to within 6% and has an approximately T^3 dependence. It is concluded that selective phonon mode softening is not the major factor determining the temperature dependence of the resistivity in this range. (auth)

32692 STRAIN FIELD INTERACTIONS WITH AXIAL DOMAINS IN V_6C_5. Murray, M. J.; Hannink, R. H. J. (Cambridge Univ., Eng.). Phil. Mag.; 30: No. 1, 213-217(Jul 1974).

It is shown that dislocations are particularly favorable sites for superlattice nucleation in V_6C_5. It is also shown that at temperatures slightly below the superlattice order-disorder transition temperature application of small stresses can lead to marked increases in the growth rate of axial domains. (auth)

32693 HIGH TEMPERATURE MICROCALORIMETRIC MEASUREMENTS OF THE PARTIAL MOLAR ENTHALPY OF SOLUTION OF O_2 IN CERIUM OXIDES. Campserveux, J.; Gerdanian, P. (Paris Univ., Orsay, France). J. Chem. Thermodyn.; 6: No. 8, 795-800(Aug 1974).

A Tian-Calvet type microcalorimeter has been used at 1353°K to measure directly the partial molar enthalpy of solution of O_2 in cerium oxides of compositions ranging from $CeO_{1.5}$ to CeO_2. The results are in good agreement with those of Bevan and Kordis (J. Inorg. Nucl. Chem.; 26: 1509 (1964)) and very similar to results for Pu + O obtained by Chereau et al. (C.R.H. Acad. Sci. Ser.; 272: 512 (1971)). (auth)

32694 SWELLING IN UO_2 UNDER CONDITIONS OF GAS RELEASE. Turnbull, J. A.; Tucker, M. O. (Central Electricity Generating Board, Berkeley, Eng.). Phil. Mag.; 30: No. 1, 47-63(Jul 1974).

A model is developed to describe the kinetics of swelling in nuclear fuels during irradiation, when tunnels formed along grain edges by the coalescence of fission gas bubbles interlink with one another to form a network through which the entrained gas can escape to the surroundings. The predicted dependence of swelling on time, rating, external restraint pressure, and temperature is physically acceptable and in qualitative agreement with existing observations. (auth)

32695 MAGNETIC PROPERTIES OF THE UAs–US ALLOYS AT LOW TEMPERATURES. Suski, W.; Palewski, T.; Mydlarz, T. (Polska Akademia Nauk, Wroclaw). Int. J. Magn.; 4: No. 4, 305-308(Dec 1973).

The magnetization of polycrystalline samples from the $UAs_{1-x}S_x$ system has been investigated in the temperature region 4.2 to 200°K and in a magnetic field up to 80 kOe. The sample with x = 0.15 appears to be antiferromagnetic in the whole temperature and field region, those with x = 1, 0.6 and 0.4 are ferromagnetic with a peculiar temperature-dependence of the magnetization, while the samples with x = 0.25 and 0.2 exhibit antiferromagnetic order in magnetic fields below 3 and 35 kOe, respectively, and become ferromagnetic above these field strengths. (auth)

32696 MAGNETIZATION STUDIES IN RARE EARTH ORTHOCHROMITES. III. $TmCrO_3$. Hornreich, R. M.; Wanklyn, B. M.; Yaeger, I. (Weizmann Inst. of Science Rehovolth, Israel). Int. J. Magn.; 4: No. 4, 313-320(Dec 1973).

The magnetization and principal magnetic susceptibilities of $TmCrO_3$ were measured from ambient down to 2.2°K. It was found that $TmCrO_3$ exhibits a weak ferromagnetic moment in the a crystallographic direction below T_N = 124°K. A compensation point was observed at T = 28.5°K. The results are interpreted in terms of the exchange interaction between the Cr^{3+} spins and the electrons occupying the lowest-lying triplet of crystal field states of the Tm^{3+} ion. The crystal field splittings between these levels in $TmCrO_3$ are 22 and 33°K and are essentially the same as those in isomorphous $TmFeO_3$. In zero-applied fields the Cr^{3+} exchange field lies in the crystallographic ab plane and has, at 0°K, a magnitude of 15.5 kOe. When the spontaneous moment is rotated to the c axis by an external field the exchange field is also aligned with the c axis and is 13 kOe at 0°K. An S = 1 spin Hamiltonian is used to describe the three low-lying levels. Its g tensor, in the principal axis system is found to be $g_x = 3.6$, $g_y = 4.2$, and $g_z = g_c = 6.0$. The x axis makes an angle of 40° with the a crystallographic axis. The Tm^{3+} transition metal coupling in $TmCrO_3$ is found to be stronger than that in $TmFeO_3$. It is argued that this underlies the significant differences in the low-temperature magnetic behavior of the two materials. (auth)

32697 OXIDATION OF $Nb_{12}O_{29}$. Electron Microscopy of a Solid-State Reaction. Browne, J. M.; Anderson, J. S. (Oxford Univ.). Proc. Roy. Soc. (London), Ser. A; 339: No. 1619, 463-482(20 Aug 1974).

The two forms—monoclinic and orthorhombic—of the mixed valence Nb (IV, V) oxide $Nb_{12}O_{29}$ oxidize at relatively low temperatures to two new modifications of Nb_2O_5. These, like the starting materials, are of the "block" structure type, derived from the DO_9 structure by crystallographic shear. Electron microscopy and electron diffraction show that the first distinct stage after complete oxidation is the formation of a super-lattice structure derived from the structure of the original $Nb_{12}O_{29}$; this undergoes internal reorganization leading, in the case of the monoclinic oxide, to the formation of a new modification of niobium pentoxide, $Nb_{10}O_{25}$, with a $(3 \times 3)_1$ block structure. By using high resolution lattice imaging methods, the course of the initial oxidation step, the formation of the superlattice and its subsequent rearrangement have been traced in considerable detail. This low temperature oxidation process, which takes place with measurable speed at temperatures as low as 110°C, clearly turns upon the diffusion of oxygen through the open channels of the DO_9 structure, and permits of a homogeneous solid state reaction involving only single unit jumps of atoms from original lattice sites into interstitial positions. At 440°C and above, a second oxidation mechanism becomes competitive, involving reaction and rearrangement at the surface of the crystals. A reaction front then passes through the crystal by the cooperative diffusion processes that are involved in the migration of crystallographic shear planes. (auth)

32698 LONG PERIOD ANTIFERROMAGNETIC LATTICES IN UX COMPOUNDS. Grunzweig-Genossar, J. (Technion-Israel Inst. of Tech., Haifa); Cahn, J. W. Int. J. Magn.; 4: No. 3, 193-198(1973).

Recent neutron diffraction experiments in certain cubic uranium compounds, e.g., $UAs_{1-x}Se_x$, have shown the presence of magnetic structures with very long periods, up to eleven lattice spacings. These structures are interpreted here as due to interactions between a proposed Fermi surface and the Brillouin zone boundaries of the magnetic structure. Some implications of the model are discussed. (auth)

32699 PbO–B_2O_3–V_2O_5 SYSTEM. Mal'tsev, V. T.; Chobanyan, P. M.; Volkov, V. L. (Rostov Engineering–Construction Inst., USSR). Zh. Neorg. Khim.; 19: No. 6, 1617-1620(Jun 1974). (In Russian).

The PbO–B_2O_3–V_2O_5 system was studied by thermal and x-ray phase methods. The fields of primary crystallization of the initial components and of the binary compounds $4PbO-B_2O_3$; $2PbO \cdot B_2O_3$; $5PbO \cdot 4B_2O_3$; $PbO \cdot 2B_2O_3$; $8PbO \cdot V_2O_5$; $2PbO \cdot V_2O_5$; and $3PbO \cdot V_2O_5$ were determined. In the sub-solidus region ternary phases of oriented composition $12PbO \cdot B_2O_3 \cdot V_2O_5$ and $20PbO \cdot 3B_2O_3 \cdot V_2O_5$ were detected. The PbO–B_2O_3–V_2O_5 system is characterized by the presence of a significant region of stratification in the liquid states adjoining the binary system B_2O_3–V_2O_5. The region of glass formation was determined and limited. (tr-auth)

32700 X-RADIOGRAPHIC STUDY OF LANTHANUM OXIDE. Solov'eva, A. E.; Gavrish, A. M.; Zoz, E. I. Zh. Neorg. Khim.; 19: No. 6, 1446-1449(Jun 1974). (In Russian).

The process of the decomposition of $La(OH)_3$ in air was studied by high temperature x-ray diffractography, and the existence of A, B, and C forms of La_2O_3 was established. The mean values of the axial and volume coefficients of thermal expansion of the A form of La_2O_3 were determined in the temperature interval from 25 to 1500°C. (tr-auth)

32701 RADIOGRAPHIC STRUCTURAL STUDIES ON THE TETRAGONAL NONMETAL BORIDES $B_{50}C_2$, $B_{50}N_2$ AND ON THE BORON CARBIDE $B_{13}C_2$. Kossobutzki, K. H. Bonn, Ger.; Bonn Univ. (1973). 162p. (In German). INIS.

Thesis. 45 refs. Available from the library of Bonn Univ.

Single-crystal structural analysis was carried out of the tetragonal compounds $B_{50}C_2$ and $B_{50}N_2$. Studies on statistic evaluation of background measurements and on accuracy of measurements of the integral intensities were also made. By balancing calculations, using Fourier and difference Fourier synthesis, it could be differentiated between the occupation of inter-icosahedron sites by boron or carbon or nitrogen. Structural analysis was also carried out for the rhombohedral compound $B_{13}C_2$. (GE)

32702 PREPARATION OF PYROLYTIC SILICON CARBIDE UNDER STATIC CONDITIONS. Erben, E.; Looman, B.; Bottelier, P. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). Metall; 28: No. 7, 695-698(Jul 1974). (In German).

6 figs.; 3 tabs.

Results concerning the pyrolytic deposition of silicon carbide by trichloromethylsilane in a static apparatus are given. Important factors in this process are the temperature of deposition, the concentration of trichloromethylsilane, the flow conditions in the deposition reactor, and the deposition basis itself. (GE)

32703 STUDIES OF THERMAL EQUILIBRIUM AT 1,250°C IN THE CO-RICH PART OF THE SYSTEM Co-W-C. Hoffmann, A.; Mohs, R. (Krupp (Friedr.) G.m.b.H., Essen (F. R. Germany). Forschungsinstitut). Metall; 28: No. 7, 661-666(Jul 1974). (In German).

3 figs.; 3 tabs.; 22 refs.

Studies of thermal equilibrium at 1250°C were carried out in the Co-rich part of the system Co–W–C for determining the solubilities of C and WC in Co. Thus the isothermal intersection in the Co-corner of the system at the given temperature is established. (GE)

32704 INELASTIC NEUTRON SCATTERING BY CERIUM HYDRIDES. I. Experimental. Vorderwisch, P.; Hautecler, S. (SCK-CEN, Mol, Belgium). Phys. Status Solidi (b); 64: No. 2, 495-501(1 Aug 1974).

Inelastic neutron scattering measurements were performed on polycrystalline samples of the cerium hydrides $CeH_{1.98}$ and

$CeH_{2.72}$ at 70°C in order to study their lattice dynamics. Results show the importance of hydrogen–hydrogen interactions. A diffusive motion of hydrogen could not be observed for both samples. (auth)

32705 INFLUENCE OF TRANSITION ELEMENT CATIONS ON MAGNETIC TRANSITION IN V_2O_3. Perelyaev, V. A.; Shveikin, G. P.; Bazuev, G. V. (Inst. of Chemistry, Sverdlovsk, USSR). Tr. Inst. Khim., Ural. Nauch. Tsentr, Akad. Nauk SSSR; No. 25, 8-12(1973). (In Russian).

The effect of the cations Sc^{3+}, Ti^{3+}, Cr^{3+}, Nb^{3+}, and Ta^{3+} on the magnetic properties of V_2O_3 and particularly on the low-temperature phase transition point of the first kind was studied. The temperature of the magnetic transition of V_2O_3 depends on the concentration and sort of alloying cation, introduced in the oxidized form. On the basis of the experimental results and literature data, a qualitative principle for the change of the phase transition temperature of the V_2O_3 was formulated. (tr-auth)

32706 INVESTIGATION OF PAIR INTERACTIONS OF Er^{3+} IONS IN YVO_4 BY PARAMAGNETIC RESONANCE. Kugler, H.; Hillmer, W.; Kahle, H. G. (Univ., Karlsruhe, Ger.). Phys. Status Solidi (b); 64: No. 2, 533-538(1 Aug 1974).

EPR measurements on YVO_4 doped with 1% of ^{170}Er were carried out in the K-band at 1.7°K to investigate the Er^{3+} pair interaction in this compound. Results for five different neighbor pairs are described by an effective spin Hamiltonian, the parameters of which were obtained by a fit to the measured resonances for various angles between magnetic field and crystal c-axis. The pair interaction is mostly due to magnetic dipole and only a small part is due to superexchange interaction. (auth)

32707 NEUTRON DIFFRACTION STUDY OF THE HYDRIDES OF THE EARLY LANTHANIDE ELEMENTS AT ROOM TEMPERATURE. Titcomb, C. G.; Cheetham, A. K.; Fender, B. E. F. (Oxford Univ.). J. Phys., C (London); 7: No. 14, 2409-2416 (21 Jul 1974).

The ordered structure of $CeD_{2.29}$ at room temperature has been determined by profile analysis of powder neutron diffraction data. A non-stoichiometric tetragonal superstructure is adopted; space group $I4_1$ md, lattice parameters a = 5.538(1), c = 11.046(2)Å. The ideal composition of the superstructure is $CeD_{2.5}$ but the fluorite phase is not ordered at this composition because of a high level of intrinsic disorder. It is presumed that the superstructure exists over a range of composition up to approximately $CeD_{2.4}$ and identical ordered structures have been determined in this range for $LaD_{2.30}$ and $PrD_{2.37}$. (auth)

32708 CONCENTRATION LIMITS OF EXISTENCE AND DEGREE OF ELEMENTARY CELL FILLING OF CUBIC ZIRCONIUM OXYNITRIDE WITH NaCl TYPE STRUCTURE. Gel'd, P. V. (Inst. of Chemistry, Sverdlovsk, USSR). Tr. Inst. Khim., Ural. Nauch. Tsentr, Akad. Nauk SSSR; No. 25, 21-25(1973). (In Russian).

Under the experimental conditions of 1500°C and 10^{-5} mm Hg, the range of homogeneity of cubic (NaCl type) zirconium oxynitride ZrN_xO_y is limited to the area adjacent to the Zr–N side of the triangular composition Zr–N–O. The elementary cell of ZrN_xO_y has structural vacancies both in the metal sublattice and in the non-metal sublattice. (tr-auth)

32709 CONDITIONS OF CUBIC ZIRCONIUM OXYCARBIDE FORMATION. Zainulin, Yu. G.; Alyamovskii, S. I. (Inst. of Chemistry, Sverdlovsk, USSR). Tr. Inst. Khim., Ural. Nauch. Tsentr, Akad. Nauk SSSR; No. 25, 33-34(1973). (In Russian).

An increase of pressure from 10^{-6} up to 400 mm Hg has no significant effect on the range of existence of ZrC_xO_y. It was assumed that the boundary of the homogeneity range of cubic ZrC_xO_y is located close to the Zr corner of the three-corner composition Zr–C–O. (tr-auth)

32710 X-RAY ELECTRON STUDY OF THE ELECTRON DENSITY DISTRIBUTION IN HYDRIDES OF THE TRANSITION ELEMENTS. Nefedov, V. I.; Salyn, Ya. V.; Chertkov, A. A.; Padurets, L. N. (Inst. of General and Inorganic Chemistry, Moscow). Zh. Neorg. Khim.; 16: No. 6, 1443-1445(Jun 1974). (In Russian).

The x-ray electron study of the hydrides of Ti, Zr, V, and Nb showed that the hydrogen atom is negatively charged. The ionicity of the metal-hydrogen bond increases in the periodic system group during transition to heavy atoms. The composition of the surface film on the hydrides was analyzed. (tr-auth)

32711 THERMAL EXPANSION OF SILICONATED PYROLYTIC CARBON. Aoki, K.; Cheng, M. Y.; Hirai, T.; Yajima, S. (Tohoku Univ., Sendai, Japan). J. Mater. Sci.; 9: No. 7, 1159-1164(Jul 1974).

The lattice and bulk thermal expansions perpendicular to the layer plane of siliconated pyrolytic carbon, PC(Si), produced by pyrolyzing a mixture of propane gas and silicon tetrachloride vapor at the deposition temperatures of 1440 to 2025°C, have been measured over the temperature ranges 20 to 550°C and 20 to 960°C, respectively. The expansion behaviors of PC(Si) are related to the density and the degree of preferred orientation of crystallites, as is the case for pyrolytic carbon without silicon "PC". At a deposition temperature of about 1700°C, the bulk thermal expansion coefficient of PC(Si) is larger than that of PC. (auth)

32712 DEFECT-ANNEALING IN NEUTRON-DAMAGED β-Ga_2O_3. Cojocaru, L. N. (Institutul de Fizica Atomica, Bucharest). Radiat. Eff.; 21: No. 3, 157-160(Mar 1974).

A study is made of the effect of fast neutrons on the electrical conductivity and thermoelectric power and also the neutron-induced defects in β-Ga_2O_3. It is found that the conductivity decreases while the thermoelectric power increases after an irradiation of about 10^{17} nvt. This is explained by assuming that the defects introduced into the Ga_2O_3 lattices act as trapping centers for electrons. The defects anneal by thermally activated processes at temperatures up to about 1000°K with an activation energy of about 2 eV. The defects are the most likely vacancies of the gallium atoms. (auth)

32713 TRANSITION-METAL OXIDES. Rao, C. N. R. (Indian Inst. of Tech., Kanpur). pp 455-563 of Solid State Chemistry. Rao, C. N. R. (ed.). New York; Marcel Dekker, Inc. (1974).

The crystal chemistry, phase equilibria, and electrical, magnetic, and optical properties of the oxides of Ti, V, Fe, Zr, W, and Re are reviewed. (12 fig, 560 references). (JSR)

32714 A METHOD OF PRODUCING FINE OXIDE POWDERS. Tagaki, Hiroyoshi; Sano, Shiro; Ishii, Eiichi (Government Industrial Research Inst., Nagoya (Japan)). Ber. Deut. Keram. Ges.; 51: No. 8, 234-235(Aug 1974). (In German).

3 figs.; 12 refs.

A method is described for producing alumina and zirconia–yttria powders. The crystal size of zirconia–yttria powders was determined by X-rays. Between 600°C and 1,200°C intensive crystal growth takes place. With zirconia–yttria powders, crystallization begins below 450°C. The powder thus obtained is highly reactive and sinters at 1,500°C into a dense product. By this method it is possible to produce various fine oxide powders. (auth)

32715 FORMATION CONDITIONS AND STRUCTURE OF Ni–Cr–Si–B–C COATINGS ON STEEL. Antonova, E. A.; Sinal, L. M.; Negoda, L. G. (Inst. of the Chemistry of Silicates, Moscow). Porosh. Met., Akad. Nauk Ukr. SSR; No. 8, 54-58(Aug 1974). (In Russian).

Alloying with carbon (0.1 to 0.5 wt. %) decreases the spreading out of Ni–Cr–Si–B melts along the steel and decreases the runoff of the coating during the formation process in vacuum in the temperature range from 1000 to 1100°C. Carbon enters into the composition of the chromium boride crystals, alloys the solid solution and eutectic, and forms chromium carbide. The microhardness of the structural component and the total hardness of the coating are improved. (tr-auth)

32716 SINTERING OF THE TECHNICAL BORON CARBIDE. Grabchuk, B. L.; Kislyi, P. S. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 8, 11-16(Aug 1974). (In Russian).

Kinetics of technical boron carbide sintering in vacuum is studied by means of high-temperature dilatometer with automatic record of changes in the pressed parts dimensions during sintering. The porosity of the sintered samples is measured and their microstructure is investigated. It is shown that fine powder and high temperatures of sintering being applied, the low-porous articles of boron carbide may be obtained by means of pressing and subsequent sintering. (auth)

32717 ZIRCONIA PRODUCTS FOR ALUMINUM SMELTING FURNACES. Starikov, N. A.; Logoida, V. M.; Fomenko, V. A.; Bogoslovskaya, L. N. Refractories (USSR) (Engl. Transl.); No. 11-12, 737-738(1973).

Translated from Ogneupory; 14: No. 12, 5-7(Dec 1973).

Zirconia molded parts are being produced for Al smelting furnaces. The steps in producing the briquettes and some of their properties are described. (DLC)

32718 INVESTIGATION OF BORIDE COATINGS INTERACTION WITH REFRACTORY METALS. Burykina, A. L.; Dzyady-

kevich, Yu. V. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 8, 63-67(Aug 1974). (In Russian).

Kinetics and structure of phases formed during interaction of boride coatings with refractory metals within a temperature range of 1200 to 1400°C for niobium and 1400 to 1600°C for molybdenum and tungsten for 1 to 10 h were studied by the methods of metallography, microdurometry, x-ray phase, and micro-x-ray spectrum analyses. It is established that in the boride coating on molybdenum and tungsten at 1600°C and holding period above 10 h a complete transformation of the MeB phase into the lower boride Me_2B takes place. Niobium monoboride within the investigated temperature-time range does not interact with the backing. (auth)

32719 MICRO-X-RAY SPECTRUM EXAMINATIONS OF INTERPHASE INTERACTIONS IN SYSTEMS-A REFRACTORY COMPOUND-LIQUID METAL. Communication II. Samsonov, G. V.; Sharkin, O. P.; Panasyuk, A. D.; D'yakonova, L. V. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 8, 68-73(Aug 1974). (In Russian).

Micro-x-ray spectrum examinations of the contact zone of interaction for the system CrB_2-Ni determined the presence of chemical reactions on the interface. It is established that in this system there occurs dissolution of boron and chromium in liquid nickel with formation of chromium solid solution in nickel boride alongside with the given phase, ternary boride of the $Cr_{2+x}N_yB_4$ type, where $0.8 \leq x \leq 1$, $0.3 \leq y \leq 1$ is present in the interaction zone i.e. the complex boride possesses a wide domain of homogeneity. An effect of oxide films on the chromium diboride surface was studied as applied the character of liquid nickel chromium diboride interaction. It is established that the presence of the oxide films favors the chemical interaction of liquid nickel with chromium boride-the interaction zone becomes deeper; this is explained by formation lower chromium borides when the chromium borate contained in the oxide films decomposes. (auth)

32720 SHOCK WAVE EFFECT ON REFRACTORY COMPOUNDS. Communication III. Anan'in, A. V.; Breusov, O. N.; Dremin, A. N.; Ivanova, V. B.; Pershin, S. V.; Tatsii, V. F.; Fekhretdinov, F. A. (Inst. of New Chemical Problems, Moscow). Porosh. Met., Akad. Nauk Ukr. SSR; No. 8, 74-79(Aug 1974). (In Russian).

Technical lanthanum hexaboride powder was studied as affected by shock waves with amplitudes to 350 kbar. The samples treated with explosion differ from the initial ones in properties. Activation of lanthanum hexaboride with shock waves permits the strong cakes with residual porosity less than 10% to be produced from lanthanum hexaboride at 2100°C, whereas the sintering of the initial product at 2410°C gives compacts with residual porosity of 20%. (auth)

32721 IRON-BORIDE EUTECTIC-CONTAINING MATERIALS (IBEM). Mashkov, A. K.; Chernienko, V. V. (Omsk Polytechnical Inst., USSR). Porosh. Met., Akad. Nauk Ukr. SSR; No. 8, 59-62 (Aug 1974). (In Russian).

The results are presented of studies in mechanical properties of materials obtained by impregnation of iron pressed parts with eutectic alloys of the systems Fe-B, Ni-B and Co-B. The possibility is shown to harden eutectic alloys from the liquid state, which increases their strength. It is established that the above-mentioned alloys may be applied to impregnate the wire briquettes. (auth)

32722 SOME PROPERTIES OF CERMETS OF THE TITANIUM CARBIDE-STEEL TYPE WITH MOLYBDENUM ADDITIVES. Sleptsov, V. M.; Kirilenko, S. N.; Naumenko, V. Ya.; Verkhoturov, A. D.; Neschetnyi, V. A. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 8, 45-49(Aug 1974). (In Russian).

The compact (porosity 0.5 to 1.5 vol.%) heat-treated cermets of the TiC-X18H15 and TiC-P18 type with molybdenum additives into a steel binder are obtained by combined grinding, pressing, and subsequent sintering in vacuum (1.10^{-3} mm Hg). Hardness, bending strength, abrasion wear, and electroerosion resistance in dilatometric treatment are measured on heat-treated cermet samples. It is established that introduction of 15 to 17 wt% of molybdenum into the binder of steel X18H15 increases essentially the mechanical properties of cermets of the TiC-X18H15 type. Alloying of the steel P18 binder with molybdenum has no essential effect on the mechanical properties of the heat-treated cermets of the TiC-P18-Mo type. Comparatively high mechanical properties of heat-treated cermets of the titanium carbide-steel type testify to the possibility of their practical utilization as tungsten-free hard alloys. (auth)

32723 INVESTIGATION OF CREEPING IN BINARY SYSTEMS TiB_2-TiC, ZrB_2-ZrN. Spivak, I. I.; Andrievskii, R. A.; Klimenko, V. V.; Lazarenko, V. D. Porosh. Met., Akad. Nauk Ukr. SSR; No. 8, 17-21(Aug 1974). (In Russian).

The creeping rate is studied in two-phase compositions within the systems TiB_2-TiC, ZrB_2-ZrN. An anomalous increase of the creeping rate is established for alloys with approximately the same concentration of the components. The size of inclusions in the composing phases has an essential influence on absolute values of deformation. (auth)

32724 PHASE DIAGRAMS OF THE Cr-HfC AND Cr-ZrC SYSTEMS. Shurin, A. K.; Dmitrieva, G. P. (Inst. of Metal Physics, Kiev). Metallofizika; No. 51, 105-109(1974). (In Russian).

Quasibinary cross sections Cr-HfC and Cr-ZrC of the ternary phase diagram of Cr-Hf-C and Cr-Zr-C were constructed by differential thermal, metallographic, and x-ray analysis methods. The cross sections studied were attributed to the eutectic type. In equilibrium with α-Cr, the monocarbides HfC or ZrC occurred. The temperature of the eutectic equilibrium in the Cr-HfC phase diagram is $1810 \pm 20°$ and the eutectic alloy contains 3 mol % HfC. The temperature of the eutectic equilibrium in the Cr-ZrC phase diagram is $1785 \pm 20°$. The alloy with the eutectic composition contains 4.2 mol % ZrC. (tr-auth)

32725 ELECTRONIC BAND STRUCTURE OF VANADIUM OXIDE (VO). Kraan, D. J. Delft, Netherlands; Technische Hogeschool (1974). 93p.

Thesis.

Semiconductor-to-metal transitions in vanadium oxides are investigated. Chapters are included on collective versus localized electron models, band structure calculations, and interpolations of combination of atomic orbitals. (JRD)

32726 YTTRIUM OXIDE ADDITIVES AS A FACTOR IN THE PROPERTIES OF PERICLASE REFRACTORIES. Kaibicheva, M. N.; Kamenskikh, V. A.; Panov, G. A. (Ural Polytechnic Inst., Sverdlovsk, USSR). Refractories (USSR) (Engl. Transl.); 14: No. 11-12, 720-721(1973).

Translated from Ogneupory; 14: No. 11, 54-55(Nov 1973).

The use of Y_2O_3 to prevent the decomposition of periclase (MgO) in furnaces was studied. 0.1 or 2.0% Y_2O_3 was added to fused magnesites and their effects on the grain size, sintering, mechanical properties (deformation onset), and thermal stability determined. (DLC)

32727 REFRACTORY PRODUCTS FROM ZIRCONIUM DIOXIDE AND METAL POWDERS WITH PHOSPHATE BINDER. Amirov, R. A.; Abzgil'din, F. Yu.; Khoroshavin, L. B. Refractories (USSR) (Engl. Transl.); 14: No. 11-12, 722-724(1973).

Translated from Ogneupory; 14: No. 11, 56-58(Nov 1973).

Bodies containing zirconium dioxide and a metal powder (Cr, Ti, or Ni) give a reasonably strong material when a phosphate binder is used. The thermophysical, physicomechanical, and other properties of the product vary with the proportion of added metal powder. Certain metals, e.g., nickel, reduce the kilning temperature to 160-400°C so that the area of utilization of the product is greatly extended. Materials containing up to 30% metal component possess good refractory and heat insulation properties and are appreciably stronger and resistant to thermal shocks than products from zirconium dioxide alone. Some of the materials can thus be used as heat insulation materials and linings of high strength and spalling resistance while others are suitable as heat-conducting materials. (auth)

32728 CHANGES IN CRYSTALLINE STRUCTURE OF IRRADIATED URANIUM DIOXIDE. Kosenkov, V. M.; Kuz'min, V. I.; Lebedev, I. G.; Shushanov, V. D. At. Energ. (USSR); 37: No. 2, 139-143(Aug 1974). (In Russian).

UO_2 particles dispersed in an inert matrix become amorphous after irradiation at 160 to 600°C, beginning with ~3% and ~15% burnup of heavy atoms for particle sizes of ~20 and 400-500 microns, respectively. The amorphism is assumed to occur mainly as a result of microstresses in the UO_2 lattice during formation of a nonequilibrium solid solution of UO_2 with fission fragments and an excess of oxygen in the case of small particles. The annealing of UO_2 particles at a temperature of 930°C restores the coherent scattering ability of UO_2. High-temperature irradiation does not result in amorphism. The decrease in UO_2 lattice spacing as a result of subsequent annealing coincides in magnitude with the decrease as a result of irradiation at higher temperatures. This decrease is due to the replacement of uranium by fission fragments as a result of changes in chemical composition during fission and additional oxidation from oxygen released during fission. Calculations and experimental data show that no

noticeable excess of oxygen in the UO_2 lattice is formed during high burnup. (auth)

32729 THERMIONIC EMISSION OF BORON- AND LANTHANUM-COATED BORON FILAMENTS. Wolff, E. G. (Northrop Research and Tech. Center, Hawthorne, CA). J. Appl. Phys.; 45: No. 9, 3840-3843(Sep 1974).

Thermionic emission from boron filaments exposed to a lanthanum metal vapor flux was studied with a view towards development of filamentary lanthanum hexaboride (LaB_6) emitters. The emission was continually monitored in both stationary and continuous coating processes. A Richardson plot of uncoated-boron-filament emission data yields $\phi = 4.38$ eV and $A = 22$ A/cm^2°K^2 for the temperature region 1550–1855°K. Current densities equivalent to LaB_6 emission were obtained for optimally coated filaments. Coated-filament strength data, possible reaction mechanisms, and potential process limitations are also presented. (auth)

32730 ROLE OF Y_2O_3 AND SiO_2 ADDITIONS IN SINTERING OF AlN. Komeya, K.; Inoue, H.; Tsuge, A. (Tokyo Shibaura Electric Co., Ltd., Kawasaki, Japan). J. Amer. Ceram. Soc.; 57: No. 9, 411-413(Sep 1974).

The effects of additions of Y_2O_3 and SiO_2 on the sintered density of aluminum nitride were studied. It was found that a fibrous structure was formed in an Al–Si–O–N phase after addition of SiO_2 to Al–Y_2O_3. An increase in fiber content at higher SiO_2 addition levels was accompanied by an increase in the volume of the Al–Si–O–N phase. (JRD)

32731 THERMOGRAVIMETRIC STUDIES OF THE HIGH TEMPERATURE THERMODYNAMIC PROPERTIES OF PLUTONIUM OXIDES. Soerensen, C. O. T. (Research Establishment, Riso). pp 96-104 of Symposium on Thermal Analysis. Stockholm; Scandinavian Council for Applied Research (1973).

From 2nd Nordic symposium on thermal analysis; Riso, Denmark (13 Sep 1973). See CONF-7309114-.

Plutonium oxides are used as fuel material in power reactors. In order to choose the best fabrication conditions for these oxides, as well as to predict their behavior in the reactor it is important to know their thermodynamic properties accurately over an extended temperature range. Work on the determination of thermodynamic data by thermogravimetric measurements is reviewed for pure PuO_2 and for UO_2–20% PuO_2 mixed oxides in the temperature range 900 to 1500°C and in different atmospheres consisting of CO_2/CO mixtures. These measurements were carried out in an "active" thermobalance enclosed in a glove box system. (auth)

Metals and Alloys

Refer also to abstract 33046.

Corrosion and Erosion

Refer also to abstract 34161.

32732 (AD-768153) OXIDATION OF COLUMBIUM AND COATED COLUMBIUM ALLOYS. Levy, M.; Falco, J. J.; Herring, R. B. Jul 1973. 30p. (AMMRC-TR-73-35). NTIS.

Oxidation of Nb alloys FS-85, SU-31, and a complex disilicide coating/SU-31 and FS-85 alloy systems has been studied in the temperature range 1400 to 2700°F at 1 atm and 50 cm/s flow rate of air. For studies of the uncoated alloys, the flow rate and pressure dependence of the alloys was also investigated. The experimental methods include thermogravimetric measurements of oxidation rates and studies on reacted specimens by means of x-ray diffraction, metallographic techniques, and electron microprobe analysis. Two anomalies in the temperature dependence of the oxidation rate were observed for both alloys and were related to the oxides formed. The SU-31 alloy has the best oxidation resistance. The oxidation mechanism of the alloys is discussed along with the mechanism of protection afforded by the complex disilicide coating system. The coating did not fail after 1000 h of oxidation. (Corros. Abstr.)

32733 (AD-778335) EFFECT OF VANADIUM AND SODIUM COMPOUNDS ON ACCELERATED OXIDATION OF NICKEL-BASE ALLOYS. Final Report, 1 March 1970–31 December 1973. Bornstein, N. S.; Decrescente, M. A.; Roth, H. A. (United Aircraft Corp., East Hartford, Conn. (USA). Research Labs.). Apr 1974. Contract N00014-70-C-0234. 106p. (UARL-N-911648-1). NTIS $4.50.

The oxidation of nickel-base alloys in the presence of gaseous and condensed alkali sulfates, alkali vanadates, and V_2O_5 was studied. It was found that in the presence of condensed alkali sulfates, oxide ions present in the melt react with and render the normally protective oxide scale ineffectual. The corrosion associated with alkali sulfates can be controlled by the presence of compatible oxides which preferentially react with the oxide ions to form innocuous compounds. V_2O_5, like the alkali sulfates, accelerates the oxidation rate of nickel-base superalloys. The product of the reaction between V_2O_5 and the substrates is dependent upon the alloying elements present in the alloy. In the absence of alloying elements such as Al and Ti, the products are vanadates. However, when the alloys contain Al and/or Ti, the product of the reaction appears to be a glass. The study is related to corrosion inhibitions in vanadium-containing fuels in gas turbines. (GRA)

32734 (N-74-17287) ENVIRONMENTAL PROTECTION TO 922°K (1200°F) FOR TITANIUM ALLOYS. Final Report. Groves, M. T. (TRW, Inc., Cleveland, Ohio (USA)). Nov 1973. 112p. (NASA-CR-134537; ER-7704). NTIS $8.75.

Evaluations are presented of potential coating systems for protection of titanium alloys from hot-salt stress-corrosion up to temperatures of 755°K and from oxidation embrittlement up to temperature of 922°K. Diffusion type coatings containing Si, Al, Cr, Ni, or Fe as single coating elements or in various combinations were evaluated for oxidation protection, hot-salt stress-corrosion (HSSC) resistance, effects on tensile properties, fatigue properties, erosion resistance, and ballistic impact resistance on an alpha and beta phase titanium alloy (Ti–6Al–2Sn–4Zr–2Mo). All of the coatings investigated demonstrated excellent oxidation protectiveness, but none of the coatings provided protection from hot-salt stress-corrosion. Experimental results indicated that both the aluminide and silicide types of coatings actually decreased the HSSC resistance of the substrate alloy. The types of coatings which have typically been used for oxidation protection of refractory metals and nickel base superalloys are not suitable for titanium alloys because they increase the susceptibility to hot-salt stress-corrosion, and that entirely new coating concepts must be developed for titanium alloy protection in advanced turbine engines. (STAR)

32735 (N-74-18176) CORROSION OF OXYGEN-DOPED TANTALUM BY LITHIUM. Stecura, S. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Mar 1974. 24p. (NASA-TM-X-2989; E-7685). NTIS $3.00.

The increase in the penetration of tantalum by liquid lithium with increasing oxygen content of tantalum results from the ability of lithium to extract oxygen from tantalum oxides, regions of high oxygen concentrations, or both, and accompanied by the creation of minute channels. At low oxygen concentrations, oxides are present primarily at the grain boundaries, and the lithium penetration is primarily intergranular. At higher oxygen concentrations, oxides and regions of high oxygen concentration are present both at grain boundaries and within the grains; the lithium penetration is both intergranular and intragranular. For a specific oxygen concentration the severity of corrosion decreases with increasing temperature because: (1) the oxygen solubility increases with temperature, decreasing the number of oxide particles and/or regions of high oxygen concentration; and (2) the diffusivity of oxygen in tantalum increases, allowing more rapid oxygen removal at the tantalum–lithium interface. (STAR)

32736 (N-74-19167) EFFECT OF LONG-TIME, ELEVATED-TEMPERATURE EXPOSURES TO VACUUM AND LITHIUM ON THE PROPERTIES OF A TANTALUM ALLOY, T-111. Buzzard, R. J.; Sheffler, K. D. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Mar 1974. 35p. (NASA-TN-D-7548; E-7589). NTIS $3.25.

Exposure conditions were for 1000 hours at 980 or 1315°C, 5000 hours at 1315°C, and a duplex temperature exposure of 1000 hours at 980°C plus 4000 hours at 1040°C. The exposures resulted in reduced tensile and creep strengths of the T-111 in the 900 to 1100°C temperature range where a dynamic strain-age-strengthening mechanism is operative in this alloy. This strength reduction was attributed to the depletion of oxygen from solid solution in this alloy. (auth)

32737 (N-74-20130) EFFECTS OF LOW-PRESSURE AIR ON OXYGEN CONTAMINATION AND LITHIUM CORROSION OF A TANTALUM ALLOY, T-111, AT 980 AND 1260°C. Gahn, R. F. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Apr 1974. 24p. (NASA-TN-D-7588; E-7640). NTIS $3.00.

The effects were studied of low-pressure air on contamination and corrosion in the tantalum alloy T-111/lithium system at 980

and 1260°C. Capsules of T-111 containing lithium were exposed to six vacuum levels between 1×10 to the 8th power and 0.0003 torr by controlled air leakage into a vacuum system. Capsules exposed at 980°C and 0.0002 torr failed from intragranular oxidation. The remainder of the capsules completed the 96-hour tests. The depth of oxygen contamination was greater at 980°C than at 1260°C. Tests made at 0.0001 and 0.00001 torr levels caused large increases in the oxygen content of the T-111. Tests at 0.000001 torr or less produced no significant contamination. No lithium corrosion of the T-111 was observed under any of the conditions. (STAR)

32738 (N-74-21135) EVALUATION OF TANTALUM-ALLOY-CLAD URANIUM MONONITRIDE FUEL SPECIMENS FROM 7500-HOUR, 1040 C PUMPED-LITHIUM-LOOP TEST. Watson, G. K. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Apr 1974. 35p. (NASA-TN-D-7619; E-7753). NTIS $3.25.

Simulated nuclear fuel element specimens, consisting of uranium mononitride (UN) fuel cylinders clad with tungsten-lined T-111, were exposed for up to 7500 h at 1040°C in a pumped-lithium loop. The lithium flow velocity was 1.5 m/s in the specimen test section. No evidence of any compatibility problems between the specimens and the flowing lithium was found based on appearance, weight change, chemistry, and metallography. Direct exposure of the UN to the lithium through a simulated cladding crack resulted in some erosion of the UN in the area of the defect. The T-111 cladding was ductile after lithium exposure, but it was sensitive to hydrogen embrittlement during post-test handling. (STAR)

32739 (N-74-22312) STUDIES OF HEAT RESISTANT MATERIALS FOR HIGH TEMPERATURE GAS REACTOR. Sekino, S. (Nippon Steel Corp., Kitakyushu, Fukuoka. Technical Research Inst. of Yawata Works). May 1974. Translated from pp 1-21 of Koon Gasu Ro Yo Tainetsu Zairyo No Kento. (NASA-TT-F-15576). 30p. NTIS $4.50.

MHD power generation may be of assistance in the energy crisis from the standpoint of improved energy efficiency; high-temperature gas reactors are noted for their high efficiency. The GGA Company has developed a large-scale commercial high-temperature gas reactor whose prospects for the future are good. A preliminary requirement for using high-temperature gas economically and safely is the development of heat-resistant materials. Data are summarized concerning the suitable existing alloys, including current candidates. Data on corrosion resistance, creep resistance, thermal fatigue resistance, structural stability, weldability, and machinability are reported. (auth)

32740 (SAND-74-0145) REACTION OF URANIUM AND ITS ALLOYS WITH WATER VAPOR AT LOW TEMPERATURES. Magnani, N. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). Aug 1974. Contract AT(29-1)-789. 25p. Dep. NTIS $4.25.

The rate of hydrogen generation of several uranium alloys exposed to 100% R.H. O_2 and N_2 at 75°C were determined. Data show that as the level of alloy addition increases, the rate of generation decreases and that O_2 inhibits the rate of generation. Mechanical properties tests have shown that at strain rates of 0.03 min^{-1}, U-4.5 wt % Nb aged at 260°C for 80 h is not affected by up to 6-month exposures to humidity while U-0.75 wt% Ti aged at 380°C for 6 h does show a significant decrease in ductility after 2 weeks exposure to moisture. (8 figs., 3 tables)

32741 INTERGRANULAR ATTACK IN LMFBR CLADDING: A COMPARISON OF LABORATORY AND IN-REACTOR RESULTS. Lannin, T. E.; Aitken, E. A.; Evans, S. K. (General Electric Co., Pleasanton, CA). Contract AT(0-4)-189. pp 70A-70E of Eighth National Conference on Electron Probe Analysis. Bethlehem, PA; Lehigh Univ. (1973).

From 8th national conference on electron probe analysis; New Orleans; Louisiana, USA (13 Aug 1973). See CONF-730809-.

32742 EFFECT OF ALLOYING ADDITIONS ON SEAWATER CORROSION RESISTANCE OF IRON-ALUMINUM BASE ALLOYS. Nachman, J. F.; Duffy, E. R. (International Harvester Co., San Diego, CA). Corrosion; 30: No. 10, 357-365(Oct 1974).

Wrought sheet corrosion specimens of varying aluminum (6 to 16%), molybdenum (to 8%), chromium (to 2%), copper (to 3%) and nickel (to 3%) were exposed to ambient and boiling seawater. Corrosion weight losses were measured and compared to AISI-SAE 1008 steel and Cupro-nickel (CDA 706) as baseline materials. The more promising alloys were rotated in ambient and 190°F (90°C) seawater at velocities up to 15 fps (4.58 m/s) to evaluate resistance to erosion-corrosion. A minimum of 10% Al was found necessary to maintain a protective oxide film. Under certain conditions, molybdenum additions up to 4% reduced corrosion weight losses by an order of magnitude. Cr, Ni, and Cu additions were found to impart only slight improvement and, in certain cases, were detrimental to corrosion resistance. Weldments of copper-containing alloys were subject to selective corrosive attack, and those of low-Al (10%) content were found to be unsuitable in hot seawater. (21 figs., 3 tables) (auth)

32743 HYDROGEN INDUCED DAMAGE IN PICKLED AND ANODIZED Ti-6Al-4V ALLOY SURFACES. Das, K. B.; Marceau, J. A. (Boeing Co., Seattle). Corrosion; 30: No. 9, 324-327(Sep 1974).

A study was undertaken to investigate a possible relationship between pickling time and the amount of hydrogen introduced in the pickling process. Results are given of surface and bulk hydrogen analysis of Ti-6Al-4V alloy specimens which were pickled according to a predetermined schedule. Hydrogen content in the alloy increased with pickling time, but the rate of absorption was higher for shorter time tests (less than 2 minutes) than for longer time tests (greater than 5 minutes). Alkaline etching significantly reduced the hydrogen pick-up. Sufficient hydrogen in the alloy resulted in failure of the adhesively bonded oxide coating formed during a subsequent anodization treatment. (5 figs.) (auth)

32744 GAS CHROMATOGRAPHIC STUDY ON THE KINETICS OF URANIUM OXIDATION IN MOIST ENVIRONMENTS. Kondo, T. (Japan Atomic Energy Research Inst., Tokai); Beck, F. H.; Fontana, M. G. Corrosion; 30: No. 9, 330-339(Sep 1974).

Oxidation kinetics of metallic uranium in moist gaseous media and its correlation to the surface morphology were studied by means of a gas chromatographic technique. Results substantiated the concept of a hydride fracture mechanism for the rapid oxidation at near ambient temperature. Through experiments on the effect of oxygen on the kinetics of the hydrogen forming reaction, an attempt was made to explain the low degree of temperature dependence of the linear oxidation rate. Close examination of the morphology of the reaction product layers has indicated a sequence of successively occurring stages of different mechanisms. A speculation was made on the role of hydride formation and its fracture at the metal-to-oxide interface which leads the overall reaction to linearly time-dependent kinetics, in which repetition of short segments of a diffusion controlled process is involved. (15 figs.) (auth)

32745 LONG RANGE MIGRATION OF NIOBIUM DURING THE ANODIC OXIDATION OF TANTALUM ON NIOBIUM AND ALUMINUM ON NIOBIUM DUPLEX LAYERS. Rigo, S.; Siejka, J. (Univ., Paris). Solid State Commun.; 15: No. 2, 259-264 (15 Jul 1974).

A Rutherford backscattering study using 1.8 MeV ^4He ions has shown that during anodic oxidation of a Nb substrate covered by Ta or Al thin films, 15% and 25% respectively of the niobium cations reach directly the oxide-solution interface by long range migration. No similar phenomena were observed when Al or Ta substrates were covered with various metals. Using ^{18}O enriched solutions it was shown, by means of nuclear microanalysis, that the initial order of oxygen is conserved during the anodic oxidation of all duplex layers, independently of the cationic movement mechanism. (auth)

32746 INVESTIGATION OF THE CORROSION OF ZIRCONIUM ALLOYS IN THE PRIMARY LOOPS OF WATER-MODERATED WATER-COOLED REACTORS AND THE USE IN THEIR MAKEUP OF PEARLITIC STEEL. Margulova, T. Kh.; Voronova, V. P.; Malova, T. I. (Moscow Power Inst.). Therm. Eng. (USSR) (Engl. Transl.); 20: No. 10, 121-124(Oct 1973).

Translated from Teploenergetika: 20: No. 10, 83-85(1973).

An investigation of corrosion protection of Zr-base alloys in aqueous solutions containing NH_3, K, H_3BO_3, and Trilon B was conducted in a pilot plant loop constructed of stainless steel and pearlitic steel. Zr alloy corrosion rates were measured by weight gain. The loop conditions simulated those found in water-moderated water cooled reactors. Results of the test show the advisability of mixed ammonia-potassium treatment by periodic addition of Trilon B at reactor startup or after shutdown. (JRD)

32747 OXIDATION OF TANTALUM FILM ON SILICON. Revesz, A. G.; Allison, J.; Kirkendall, T.; Reynolds, J. (COMSAT Labs., Clarksburg, MD). Thin Solid Films; 23: No. 3, S63-S66 (Oct 1974).

Interactions in Si/Ta/Ta oxide structures were studied in thin Ta films deposited on Si substrates. The films were oxidized in oxygen at 350 to 700°C. Electron microscopy revealed that Si interacts with the Ta film during oxidation so that co-oxidation of Ta and Si occurs. The occurrence of these reactions may be

the basis for research on development of MIS devices using insulators other than SiO_2. (JRD)

Preparation and Fabrication

Refer also to abstracts 31920, 32668, 34379, and 34381.

32748 (LA-UR-74-937(Rev.)) HIGH RATE PHYSICAL VAPOR DEPOSITION OF REFRACTORY METALS. Sherman, M. A.; Bunshan, R. F.; Beale, H. A. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 39p. (CONF-740645-2). Dep. NTIS $5.00.

From vacuum metallurgy conference; Pittsburgh, Pennsylvania, USA (17 Jun 1974).

Mechanical properties of Mo, Nb, and V bulk deposits produced by high rate physical vapor deposition techniques (HRPVD) were studied. Yield strengths of Mo and Nb were comparable to those of wrought material having equivalent grain sizes. An average yield strength of 36.1 kg/mm^2 was obtained in V deposits of 0.7 μm grain size; this high yield strength is primarily due to grain size refinement and not the interstitial content. Ultra fine-grained refractory metals may greatly reduce void formation and growth in irradiated materials in fast breeder and controlled thermonuclear (CTR) reactors. It is desirable to reduce void growth by removing excess vacancies (produced by the neutron irradiation). This may be accomplished by trapping the vacancies at grain boundaries. For V, at a typical operating temperature of a CTR first wall (973°K), up to 92% of the excess vacancies are trapped at the boundaries for a dislocation density of 10^8 cm^{-2}, reducing the dimensional change by an order of magnitude for a given neutron fluence. It is suggested that HRPVD techniques may be used to prepare fine-grained materials having superior resistance to swelling induced by fast neutron irradiation. (13 figs.) (DLC)

32749 ANISOTROPY OF ETCHING BEHAVIOR IN BCC TUNGSTEN AND THE PROBLEM OF EDGE-SCREW DISLOCATION DISTRIBUTIONS. Tandon, K. N.; Bilello, J. C. (State Univ. of New York, Stony Brook). Phil. Mag.; 30: No. 1, 75-84(Jul 1974).

Experiments of previous workers on bcc tungsten had shown that several etchants revealed etch-pits over the entire range of surface orientations which were not more than 35° from the (001) axis. This fact has been exploited to investigate the etch-pit distributions of polycrystals and single crystals of several axial orientations, using for each sample many etchable surfaces comprising a large angular spread of crystal planes. The density of etch-pits is not homogeneous for a given sample, but depends on the particular surface being etched. Etch-pit densities have a systematic dependence on etch-plane orientation and are consistently 10^2 to 10^3 smaller when the four (111) crystal directions make nearly equal angles with the surface of observation. Use of a scanning electron microscope permitted measurements of the pit densities to higher values than are usually associated with etch-pit methods. The results indicate that either tungsten is not reliably etchable over the range of surface planes usually assumed, or that the distributions of edge and screw are markedly different in the crystals examined. (auth)

32750 ELECTROLYTIC PRECIPITATION OF ZIRCONIUM ON A LIQUID ZINC CATHODE. Gol'dshtein, S. L.; Rakipov, D. F.; Raspopin, S. P. Tsvetn. Metal.; No. 6, 46-48(Jun 1974). (In Russian).

A study was made on the possibility of preparing Zn-Zr alloys by electrolyzing an equimolar mixture of potassium and sodium chlorides containing 0.6 wt % Zr at 700°C with the use of constant stationary and pulsing currents. By pulse electrolysis (pulsing a dc current at a definite frequency) of chloride melts depleted in zirconium, it was possible to prepare compact alloys having a high Zr content with better current yields than by stationary electrolysis (nonpulsed dc current). (SJR)

32751 METHOD OF EXTRUDING ALUMINUM COATED Nb-Ti. Mori, M.; Hahn, W. C.; Avitzur, B. (to United States Atomic Energy Commission). US Patent 3,837,066. 24 Sep 1974. Filed date 14 Feb 1973. 8p.

This investion provides a billet and a method for shaping the same for the production of composite superconductor wire composed of at least one high-yield-strength superconductor core surrounded by a low-yield-strength matrix material that is uniformly clad on and around and bonded to the core for use in magnets. In one actual billet, which has a core-to-sleeve yield strength ratio of about 7-1, the billet has a core-to-sleeve diameter ratio of between about 0.4 and 0.9 and a nose cone semi-angle of 5° for extrusion through a die semi-angle of 5° for area reductions of 39 to 65%. This billet comprises an aluminum clad niobium-titanium core with ratios of core area to sleeve area ranging from 27.5 to 100.2%. The billet is extruded without fabrication damage and/or annealing to produce a uniform bond between the superconductor core and the matrix. (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 31463, 33726, 33951, 34040, 34242, and 34266.

32752 (AD-772919) SENSITIVITY OF MATERIAL RESPONSE CALCULATIONS TO THE EQUATION OF STATE MODEL. Final Report, May-October 1973. Wray, W. O. (Systems, Science and Software, La Jolla, Calif. (USA)). Dec 1973. 66p. (SSS-R-73-1910; BRL-130). NTIS $3.75.

Three equation of state models, all of which are available as subroutines in the RIP code, are considered: (1) modified PUFF; (2) RIP mixed phase; and (3) GRAY. Each of these models is used to calculate the one-dimensional response of aluminum, beryllium and titanium; this series of calculations is performed for two distinct x-ray sources. The sensitivity of the calculated material response to the choice of equation of state model is characterized in terms of the generated impulse and the peak propagating stress at the time the radiation source is cut off. For the calculations presented, the three equation of state models are in fairly good agreement. (auth)

32753 (AD-775358) DEVELOPMENT OF ECONOMICAL SHEET TITANIUM ALLOY. Final Report, 10 April 1972-10 November 1973. Wardlaw, T. L.; Rosenberg, H. W.; Parris, W. M. (Titanium Metals Corp. of America, Henderson, Nev. (USA)). Dec 1973. 250p. (AFML-TR-73-296). NTIS $6.00.

The objective of this program was to develop an economical sheet titanium alloy. The approach was to build on the earlier work with emphasis on mill product economics consistent with formability, fabricability, and other properties required by the ultimate user. Including alloys from the earlier contracts, more than 60 compositions were evaluated. These were narrowed to three final compositions, Ti-8V-7Cr-3Al-4Sn-1Zr, Ti-8V-4Cr-2Mo-2Fe-3Al, and Ti-15V-3Cr-3Al-3Sn. Further work is recommended on all three. Each alloy exhibits good strip producibility potential while meeting the airframe industries' stated cold minimum bend requirements. Each alloy showed Erichsen cup draw depths exceeding 0.35 in. after simulated strip processing to about .040 in. gage. (GRA)

32754 (AD-775599) EFFECT OF FILLER METAL CHEMISTRY AND HEAT TREATMENT ON THE WELDABILITY OF THE Ti-6Al-2.5Mo ALLOY. Cavallaro, J. L. (Naval Ship Research and Development Center, Annapolis, Md. (USA)). Feb 1974. 70p. (NSRDC-4189; NSRDC-28-631). NTIS $3.75.

Determination was made of the effects of combined variations in weld-metal chemistry and postweld heat treatment on the mechanical properties and sea-water stress-corrosion-cracking properties of Ti-6Al-2.5Mo weldments. The composition range studied included 4% to 7% aluminum and 0.5% to 2.5% molybdenum. Good fracture toughness and stress-corrosion-cracking resistance for weld metal in the Ti-Al-Mo-O alloy system are achieved at the 110,000 lb/in^2 yield strength level. No degradation of properties was produced in the heat-affected zone of Ti-6Al-2.5Mo weldments. Results of this investigation indicate that a tougher and more ductile Ti-100 alloy weldment could be developed through control of microstructure in the Ti-Al-Mo-O and Ti-Al-V-O alloy systems. (GRA)

32755 (AD-778419) MOBILITY OF MAGNETIC CYLINDER DOMAINS. Final Report. (IBM Watson Research Center, Yorktown Heights, N. Y. (USA)). Feb 1974. Contract F44620-72-C 0060. 6p. (AFOSR-TR-74-0682). NTIS $3.00.

The objective of the project was to determine the physical mechanism of motion of cylinder (bubble) domains in magnetic films. Since the motion is influenced by crystalline defects, study of the latter was a related objective. (GRA)

32756 (AD-778498) METALLURGICAL AND PHYSICAL PROPERTIES OF HIGH-TEMPERATURE, HIGH-CRITICAL-FIELD SUPERCONDUCTING MATERIALS. Final Report, 1 March 1972-31 December 1973. Webb, G. W. (RCA Labs., Princeton, N. J. (USA)). Feb 1974. Contract F44620-72-C-0042. 18p. (PRL-74-CR-12; AFOSR-TR-74-0603). NTIS $3.00.

The compositional dependence of T(°C) was measured in a system of niobium-based pseudo-binary beta-tungsten systems. In those cases where stoichiometry with respect to niobium could be maintained, T(°C) was found to be a monotonic function of composition, suggesting a general rule. However, the critical magnetic

field strengths under the same conditions did not scale with T(°C) and did in fact sometimes exhibit maxima, proving extrinsic behavior in these materials. A general annealing effect was discovered. The lower-temperature annealing time to reach a given T(°C) in quenched specimens could be greatly accelerated by interposing a very short time anneal at somewhat higher temperatures. The high-energy neutron bombardment at room temperature of Nb_3Ga, Nb_3Al, and Nb_3Sn was found to cause 15°K depressions of T(°C) which are reversible with short anneals at 750°C. (auth)

32757 (AD-778531) EFFECT OF STRAIN ON THE MECHANICAL PROPERTIES OF MAGNESIUM ALLOYS ALLOYED WITH YTTRIUM. Sviderskaya, Z. A.; Oreshkina, A. A. 15 Apr 1974. Translated by R. E. Zarza from pp 161-166 of Splavy Tsvetnykh Metallov, 1972. 14p. NTIS $3.00.

As a result of investigations conducted recently, the favorable effect of yttrium on the peoperties of magnesium alloys at room and elevated temperatures was established (1-4). The highest strength level characteristics of these alloys are reached after prolonged artificial aging, carried out immediately after pressure shaping without hardening. The possibility of raising the strength properties of aging magnesium alloys by means of relatively small strain (5-10%) conducted prior to artificial aging was investigated in detail on alloys alloyed with neodymium, aluminum, zinc, etc., (5-8). In this case a significant hardening effect was achieved. The translation discusses research on the feasibility of raising the strength characteristics of magnesium-yttrium alloys coupled with plastic deformation and artificial aging. (GRA)

32758 (AD-778692) STRUCTURAL CHANGES IN MOLYBDENUM MONOCRYSTALS UNDER LASER IRRADIATION. Basharov, R.; Ermatov, S. E.; Kaipov, D. K.; Trekhov, E. S.; Turdybekov, I. T. 10 Apr 1974. Translated by W. R. Olsen from pp 28-30 of Voprosy Obshchei i Prikladnoi Fiziki, Alma-Ata, 1969. 6p. NTIS $3.00.

Upon irradiation by a laser flux with power density of 30,000 cal/cm^2s, cracks are formed on the surface of the molybdenum monocrystal. Expulsion of the molten mass is not observed in this case. Upon irradiation of the same monocrystal by a laser flux with power density of 100,000 cal/cm^2s, the damaged zone becomes separated from the molten mass and is surrounded by lines of deformation. The creation of cracks and lines of slippage may be explained by the high rates of cooling of the zone adjacent to the damaged zone. (GRA)

32759 (AED-CONF-74-081-005) REFRACTORY METAL-REINFORCED, SINTERED SILICIDE COMPOSITE MATERIALS. Schlichting, J. (Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Chemische Technik). 1974. 9p. (In German). (CONF-740344-1). INIS.

From meeting on composite materials; Konstans, F. R. Germany (28 Mar 1974).

15 figs.; 10 refs.

A hard component ($MoSi_2$) is combined with a ductile metallic component (Nb or Nb alloys) by plasma spraying and quasi-isostatic hot pressing. Both components are supporting components. With respect to mechanical properties and oxidation, this composite material seems to behave at 1000 to 1200°C as favorably as superalloys at 700 to 800°C. (GE)

32760 (AED-CONF-74-089-016) ANOMALY OF THE SPECIFIC HEAT OF GADOLINIUM AT THE CURIE POINT. Engelhard, J.; Peisl, H. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Dept.). 1974. 7p. (In German). (CONF-740451-15). INIS.

From conference on solid state physics; Freudenstadt, F. R. Germany (1 Apr 1974).

3 figs.; 9 refs.

A report is given on measurements of the specific heat of gadolinium in the region of the Curie point. In order to determine the critical exponents, an apparatus was set up in which a modulation method can be used with small samples and high temperature resolution for measuring the temperature dependence of the specific heat of annealed and unannealed Gd at Tc. (GE)

32761 (AEC-CONF-74-089-029) INVESTIGATIONS OF THE SURFACE PROPERTIES OF NIOBIUM BY MEANS OF THE (FLUX LOOP) PENETRATION DEPTH λH_{dc}. Kneisel, P.; Stoltz, O.; Yasaitis, J.; Halbritter, J. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). 1974. 5p. (In German). (CONF-740451-16). INIS.

From conference on solid state physics; Freudenstadt, F. R. Germany (1 Apr 1974).

Measuring equipment has been built to investigate the magnetic behavior of niobium samples having a diameter of 10 mm and a length of about 100 mm. The surface superconduction, pinning, H_{c1} and H_{c2} are examined with the aim of drawing conclusions about the preparation technique and of transferring the influence of these techniques to measurement and result on high-frequency resonators. Magnetization curves, magnetic flux curves, and depth of penetration curves were recorded and discussed. (GE)

32762 (AED-CONF-74-089-034) RECOVERY OF THE ELECTRICAL RESISTIVITY IN Ta DEFORMED AT 4°K. Peretti, H. A.; Schoeck, G. (Comision Nacional de Energia Tomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche). 1974. 6p. (CONF-740451-17). INIS.

From conference on solid state physics; Freudenstadt, F. R. Germany (1 Apr 1974).

3 figs.; 13 refs.

Tantalum wire, rolled at the temperature of liquid helium, which had undergone a special pretreatment and was partly doped with oxygen, was used as material for resistivity measurements. The increase in resistivity depending on pretreatment and deformation at 4°K and then annealed up to room temperature were measured. The oxygen-doped samples exhibited for the same deformation value a greater increase of resistivity than the pure samples. The relative changes of resistance of the normal and deformed Ta wire healed to about 35% up to a temperature of 300°K. This is relatively little compared with radiation damaged samples which exhibit a healing of about 80% at this temperature. (GE)

32763 (COO-3395-11) STRUCTURAL, THERMAL, AND ELECTRONIC PROPERTIES OF METASTABLE BINARY ALLOYS OF THORIUM AND URANIUM PRODUCED BY RAPID QUENCHING. Final Report. Giessen, B. C. (Northeastern Univ., Boston, Mass. (USA)). 1974. Contract AT(11-1)-3395. 10p/ Dep. NTIS $4.00.

Splat cooling was used to prepare and study actinide and crystal chemically related rare-earth alloys, especially Th, Pu, Np, La, and Gd, with alloying elements such as Ti, Fe, Co, Ni, Cu, and Ga. X-ray diffraction and Moessbauer effect were used. New intermetallic phases such as ThFe, ThNi, and ThCu (CrB type) and $Pu_{.60}Ga_{.40}$ (CsCl type) were found. New nonsubstitutional solid solutions, probably of the disubstitutional type, were found in Th(Fe), Th(Cu), La(Fe), Gd(Fe), and Gd(Cu) alloys with solute concentrations up to 15%; these concentrated solid solutions represent a new class of alloys. Pu and Np alloys containing the bcc high temperature modification such as ϵ-Pu(Ti) and γ-Np(Ga) were retained to RT for the first time; these alloys may be important because of the cubic actinide form retained. Pu-Ce alloys were studied and valence changes of Pu and Np in binary alloys were observed. Superconducting properties and thermal properties by differential scanning calorimetry were also measured. The structures of several other compounds of crystal chemical interest, such as $TiCu_3$(m), $(Al_{.5}Nb_{.5})Ni_3$ and Ge_xSb_y were also determined. (auth)

32764 (EURFNR-1144) STRESS-RUPTURE BEHAVIOR OF TUBES OF AUSTENITIC STEELS AND NICKEL-BASED ALLOYS UNDER INTERNAL PRESSURE STRESSES. Polifka, F.; Schaefer, L.; Kempe, H. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Material- und Festkoerperforschung). Nov 1973. Translation of KFK-1882. 50p. Dep. NTIS $5.50.

Work performed under United States-Euratom Fast Reactor Exchange Program.

The results of stress-rupture tests on tubes of seven austenitic stainless steels and five Ni-based alloys, which to some extent had different thermo-mechanical treatments, are reported. The tubes were loaded by internal gas pressure causing a biaxial stress state. The test temperatures were 600 to 750°C. The thin walled seamless precision tubes were carefully checked before in order to detect defects and dimensional variations. The outer diameter was about 6 mm. Plots of stress-rupture curves, of master curves according to Larson and Miller, of strain at fracture curves in dependence of rupture-life are presented in addition to metallographic pictures of the fracture area and difference survey tables. A short description of the experimental procedures is given. Tube stress calculations and their comparison with stress-rupture test results in uniaxial state of stress are described. (auth)

32765 (JUL-1045-FF) A MODEL CALCULATION FOR THE $\alpha-\alpha'$ PHASE TRANSITION IN METAL-HYDROGEN SYSTEMS. Horner, H.; Wagner, H. Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Festkoerperforschung). Feb 1974. 39p. INIS.

11 figs.; 2 tabs.; 16 refs. With abstract.

The $\alpha-\alpha'$ (gas-liquid) part of the phase diagram of hydrogen dissolved in metals is calculated and compared with experiments for H in Nb. The underlying lattice model includes a hard-core

repulsion between protons and an elastic interaction mediated by the host metal lattice. The long-range part of this interaction is treated in mean field approximation. For the hard-core repulsion and the microscopic part of the elastic interaction low density cluster expansions and Monte-Carlo calculations are investigated. Reasonable agreement with experimental data is obtained if the microscopic contribution of the elastic interaction is properly taken into account. (auth)

32766 (JUL-1049-FF) THE INFLUENCE OF SAMPLE DIMENSIONS ON THE THERMODYNAMIC PROPERTIES OF HYDROGEN IN METALS. Tretkowski, J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Festkoerperforschung; Technische Univ. Muenchen (F. R. Germany)). Mar 1974. 47p. (In German). INIS.

33 figs.; 49 refs. With abstract.

The concentration and temperature dependence of the elastic aftereffect and the diffusion of hydrogen in niobium, tantalum, and vanadium were determined by means of the Gorsky effect in wire and foil specimens. The spinodal found for the wire is in good agreement with the spinodal determined by solubility measurements for these systems. The temperature dependence of the elastic aftereffect is always lower for the foil than for the wire. The spinodal in the foil determined by extrapolation lies at lower temperatures than in the wire. (GE)

32767 (KFK-1993) THE CHANGE IN MECHANICAL PROPERTIES OF CLADDING MATERIALS FOR FUEL PINS OF NUCLEAR REACTORS AFTER REACTIONS WITH CARBIDE FUELS. Sarikaya, Y.; Goetzmann, O. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). May 1974. 58p. (In German). INIS.

39 figs.; 4 tabs.; 6 refs. With abstract in German and English.

Unlike the attack in an oxide fuel pin, the chemical reactions between carbide fuel and its cladding do not cause a reduction in the thickness of the cladding wall. However, a change in the mechanical properties of the cladding materials is to be expected. It was the goal of this work to investigate the changes in mechanical properties of various cladding materials (austenitic stainless steels and vanadium alloys) caused by carburization of the cladding by carbide fuels. Gas bonding (argon) as well as liquid metal bonding (sodium) was used in the tests. Uranium carbide served as carbide fuel. The results are given by many diagrams on the mechanical short-time properties of the materials, i.e., the yield strength, the rupture strength, and the rupture elongation. According to these investigations the austentitic stainless steels and the vanadium alloy VT1331l seem to be useful cladding materials for carbide pins. (GE)

32768 (KFK-EXT-6/73-6) LITERATURE REPORT ON SOME PROPERTIES OF ZIRCALOY-4 AT HIGHER TEMPERATURES. Petersen, C. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Nukleare Sicherheit). Mar 1974. 13p. (In German). INIS.

22 figs.; 17 refs. With abstract in German and English.

In this literature report, some mechanical and physical properties of Zircaloy-4 are compiled for the temperature interval of 600 to 1,800°C. The behavior of stress-strain, ultimate strength, and ductility under internal pressure, thermal expansion, thermal conductivity, and total emissivity are described. (GE)

32769 (MHSMP-74-19-F) PARTICLE CHARACTERIZATION OF TUNGSTEN. Period Covered: April–June 1974. Duncan, A. A. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1974. 7p. Dep. NTIS $4.00.

For Univ. of California Lawrence Livermore Lab.

Tungsten powder has been characterized using a semiautomatic microscopy technique. The sample analyzed included material fractioned by sieving and a material subject to severe shock treatment. (auth)

32770 (N-74-22202) COMPUTER CALCULATED PHASE DIAGRAMS FOR THE Ni–W–Al, Ni–Al–Hf, Ni–Cr–Hf and Co(Cr, Ni)–Ta–C SYSTEMS. Kaufman, L.; Nesor, H. (Manlabs, Inc., Cambridge, Mass. (USA)). 1 Jan 1974. Contract NAS3-17304. 65p. (NASA-CR-134608). NTIS $6.25.

Computer analysis of the W–Ni, W–Al, Ni–Al, Co–C, Ta–Co, Ta–C, Ta–Ni, Ta–Cr, Hf–Ni, Hf–Al, Hf–Cr, Al–W–Ni, Co–Ta–C, Al–Ni–Hf, and Hf–Cr–Ni systems has been carried out in order to predict the isothermal sections and liquidus projections for these systems. The results indicate that the Al–W–Ni and Hf–Cr–Ni systems offer opportunities for the growth of in-situ composites by means of controlled solidification, while the Al–Ni–Hf system suffers from low melting ternary eutectics. Calculation of the temperature and composition of the Co–TaC eutectic results in reasonable agreement with experimental observations and has been extended to consider effects of nickel and chromium additions on the eutectic temperature and composition. (STAR)

32771 (ORNL-4998) MECHANICAL PROPERTIES TEST DATA FOR STRUCTURAL MATERIALS. Quarterly Progress Report for Period Ending July 31, 1974. Hill, M. R. (Comp.). (Oak Ridge National Lab., Tenn. (USA)). Sep. 1974. Contract W-7405-eng-26. 432p. AT.

Test data on heat resisting alloy structural materials are presented. These data were obtained in research conducted at Aerojet Nuclear Company, Argonne National Laboratory, Hanford Engineering Development Laboratory, Naval Research Laboratory, Oak Ridge National Laboratory, University of Cincinnati, and University of California at Los Angeles. (JRD)

32772 (ORNL-SUB-3654-2) CREEP FAILURE UNDER UNIAXIAL AND MULTIAXIAL STRESS CONDITIONS. Annual Report, January 1, 1973–December 31, 1973. R and D Report LR:73:4213-01:1. Schultz, C. C.; Leyda, W. E. (Babcock and Wilcox Co., Alliance, Ohio (USA). Research Center). 19 Jul 1974. 101p. Dep. NTIS $8.25.

For Oak Ridge National Lab., TN.

A program directed to defining the progression of creep damage and the assessment of creep failure criteria is summarized. The program emphasis is on conditions of multiaxial states of stress and time-dependent loading. All testing was at 1100°F using type 304 stainless steel specimens reannealed at 2000°F (30 minutes). The results of uniaxial tests under both constant load and step-load conditions with rupture times of 100 to 10,000 hours are reported. Strain-time results are reported for several long-time tests now in progress for over 10,000 hours. Preliminary results for three multiaxial tests, now in progress, are reported. (auth)

32773 (UCID-15825) EFFECT OF KRONIG STRUCTURE ON FLUORESCER EXPERIMENTS. Del Grande, N. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Apr 1971. 26p. Dep. NTIS $4.50.

An evaluation of calibration procedures for fluorescer experiments for Krönig structure effects in metals is given. Data and discussions are included on Jump ratios, Krönig Structure theory, Krönig structure measurements, the effects of Krönig Structure in fluorescer measurements, and filter calibrations. (JRD)

32774 SATURATION OF A LIQUID METAL WITH INERT GAS IN FORCED CONVECTION FACILITIES. France, D. M.; Carlson, R. D. (Argonne National Lab., IL). Int. J. Heat Mass Transfer; 17: No. 8, 957-959(Aug 1974).

The presence of inert gas in a liquid metal system can have a significant effect on incipient boiling superheat. An analytical model is described for predicting the steady state operational time required after coolant fill to insure that the coolant will be near saturated with inert gas in the plenum. A family of curves is produced, from which time to saturation can be predicted for any reactor system, provided the plenum flow pattern resembles the analytical model. The prediction requires a knowledge of plenum geometry, liquid metal mass flow rate, and total system coolant inventory. The curves have been applied to the FFTF and to the LMFBR heat transfer simulation loop, both of which use Na and argon gas. (UK)

32775 INFLUENCE OF CRYSTAL FIELDS ON THE MAGNETIC FORM FACTOR OF SAMARIUM. de Wijn, H. W.; van Dieen, A. M.; Buschow, K. H. J. (Rijksuniversiteit, Utrecht). Solid State Commun.; 15: No. 3, 583-585(1 Aug 1974).

It is calculated that crystal fields, with inclusion of mixing higher multiplets into the ground $J = \frac{5}{2}$ state, have a substantial effect on the magnetic form factor of Sm^{3+}. From the neutron diffraction data obtained by Koehler and Moon (Phys. Rev. Lett.; 29: 1468(1972)) for the cubic site in Sm metal it follows that the quarter Γ_8 is lowest, with the sixth-order crystalline field parameter $A_6\langle r^6\rangle$ positive. The conduction electron moment residing on Sm is estimated to be of the order of $0.4\,\mu_B$. (auth)

32776 ANOMALOUS MAGNETIC BEHAVIOR AND SUSCEPTIBILITY MAXIMUM IN $CeSn_3$. Misawa, S. (Nihon Univ., Tokyo). Solid State Commun.; 15: No. 3, 507-509(1 Aug 1974).

Anomalous magnetic behavior observed in one of cerium intermetallic compounds, $CeSn_3$, is analyzed in the spirit of the Fermi liquid model, by regarding even the 4f-electrons of cerium as itinerant. It is shown that the appearance of the broad peak of the susceptibility at about 150°K can be attributed to the $T^2 \ln T$ dependence of the susceptibility on temperature. (auth)

32777 NATURE OF THE CERIUM γ REVERSIBLE α TRANSFORMATION UNDER PRESSURE. Khovostantsev, L. G.; Vereschagin, L. F.; Shulika, E. G. (Inst. of Physics of High Pressures, Moscow). High Temp.–High Pressures; 5: No. 6, 657-662 (1973).

The behavior of metallic cerium under pressure to 30 kbar and at room temperature has been studied by measurement of the Seebeck coefficient and by differential thermal analysis. These results, in conjunction with literature data on resistivity and Hall emf changes with pressure, suggest that there is an electron transition region at ~7.5 kbar followed by the $\gamma \approx \alpha$ structure transformation region at ~10 kbar. (auth)

32778 EXPERIMENTAL INVESTIGATION OF THE THERMOPHYSICAL PROPERTIES OF TUNGSTEN–RHENIUM CAST ALLOYS. II. The W–22% Re Alloy. Logunov, A. V.; Kovalev, A. I. (Inst. of High Temperature, Moscow). High Temp.–High Pressures; 5: No. 6, 635-643(1973).

The results of an experimental study of the resistivity, thermal conductivity and total hemispherical emittance of the W–22% Re cast alloy are presented. A relationship has been established between the resistivity of tungsten–rhenium alloys and their composition, and the temperature dependence of the thermal conductivity and the resistivity of the alloys and of their ratio is discussed. (auth)

32779 EXPERIMENTAL INVESTIGATION OF THE THERMOPHYSICAL PROPERTIES OF TUNGSTEN–RHENIUM CAST ALLOYS. I. The W–5% Re Alloy. Logunov, A. V.; Kovalev, A. I. (Inst. of High Temperature, Moscow). High Temp.–High Pressures; 5: No. 6, 625-633(1973).

The results of an experimental study of the resistivity, thermal conductivity and total hemispherical emittance of the W–5% Re cast alloy are presented. Questions concerning the determination of the thermal conductivity and emittance of thin metallic specimens heated by direct passage of an electric current are discussed. (auth)

32780 DISPERSION RELATIONS FOR MAGNETIC EXCITONS IN $NdAl_2$. Houmann, J. G. (Danish Atomic Energy Commission, Risoe); Bak, P.; Purwins, H. G.; Walker, E. J. Phys., C (London); 7: No. 15, 2691-2696(7 Aug 1974).

The magnetic excitation spectrum in $NdAl_2$ has been measured by means of inelastic neutron scattering at 5.3°K for momentum transfer in the ⟨110⟩ direction. Several excitation branches are observed and discussed in terms of a hamiltonian including an isotropic Heisenberg exchange interaction and a cubic crystalline electric field. The spectrum is interpreted as comprising of six excitation modes, four of which are transverse spin-wave-like excitations (two acoustic and two optical). The remaining two excitations are longitudinal in character (acoustic and optical). Values are obtained for both the exchange interaction and the crystal-field parameters. (auth)

32781 EFFECT OF LONG AGEING TREATMENTS ON STEADY-STATE CREEP IN 20% Cr–25% Ni, Nb-STABILIZED STAINLESS STEEL. McLaughlin, I. R. (Central Electricity Generating Board, Berkeley, Eng.). Metal Sci. J.; 8: No. 8, 247-252(Aug 1974).

The variation in the steady-state creep behavior with aging time of 20 Cr–25 Ni–1 Nb stainless steel was studied over a stress range of 60 to 160 N/mm^2 and at a temperature of 1023°K. After short aging times at 1023°K before creep, activation-energy values were found to be greater than that for self-diffusion (ΔH_{SD}) and to decrease with increasing applied stress. With increasing aging time, the creep activation energy became less stress-dependent and approached ΔH_{SD}. This change was accompanied by a gradual reduction in the magnitude of the stress exponent. As the aging time increases, NbC precipitates coarsen and the NbC → M_6C transformation occurs. The creep behavior is attributed to the variations of internal back-stress that accompany these changes in structure. (auth)

32782 THERMAL EMITTANCE OF STAINLESS STEELS. Humphries, J. (United Kingdom Atomic Energy Authority, Dounreay, Eng.). J. Brit. Nucl. Energy Soc.; 13: No. 3, 271-276(Jul 1974).

The thermal emittance of stainless steels varies widely even where the physical conditions of the surface are apparently similar. A study of papers on the subject shows that controls have in general been insufficient to specify the measured surfaces in sufficient detail. Analysis of existing work indicates the importance of surface damage, which has not been generally recognized. After measurement of the effects of surface damage, irregularities and film values of emittance to be used in engineering design are recommended. (auth)

32783 EFFECT OF CRYSTAL ATOMIC CHAIN DISCONTINUITY UPON CHANNELING. Firsov, O. B. (Inst. of Atomic Energy, Moscow). Radiat. Eff.; 21: No. 4, 265-267(1974).

It is shown that diffusion of transversal energy due to discontinuity of atomic chains decreases exponentially, when the transversal energy decreases. (auth)

32784 SEAMLESS AND WELDED CHROMIUM–NICKEL–IRON–MOLYBDENUM–COPPER–COLUMBIUM STABILIZED ALLOY TUBES. Philadelphia; American Society for Testing and Materials (1973). 7p. (ASTM-B-468-73).

This specification covers tubes ⅛ to 5 in. OD and 0.015 to 0.5 in. thickness. The material comprises 19 to 21% Cr, 32 to 38% Ni, bal. Fe, 2 to 3% Mo, 3 to 4% Cu, and 0.56 to 1% Nb + Ta. Mechanical properties, testing, permissible variations, etc. are covered. (10 tables) (DLC)

32785 NICKEL–IRON–CHROMIUM–MOLYBDENUM–COPPER ALLOY SEAMLESS PIPE AND TUBE. Philadelphia; American Society for Testing and Materials (1972). 9p. (ASTM-B-423-72).

This specification covers cold-drawn and hot-finished seamless pipe and tube of the composition 38 to 46% Ni–balance Fe–19.5 to 23.5% Cr–2.5 to 3.5% Mo–1.5 to 3.0% Cu, intended for general corrosive service. Chemistry, mechanical properties, permissible variations, testing, etc. are covered. (6 tables) (DLC)

32786 MOLYBDENUM AND MOLYBDENUM ALLOY BILLETS FOR REFORGING. Philadelphia; American Society for Testing and Materials (1974). 4p. (ASTM-B-385-74).

This specification covers the following types of Mo and its alloys: 360 (unalloyed arc cast), 361 (unalloyed powder metallurgy), 362 (arc-cast Mo–0.5% Ti), 363 (arc-cast TZM), 364 (powder metallurgy TZM), and 365 (unalloyed arc-cast low-carbon Mo). Chemistry, dimensions, defects, etc. are covered. (DLC)

32787 NICKEL–MOLYBDENUM–CHROMIUM ALLOY PLATE AND SHEET. Philadelphia; American Society for Testing and Materials (1971). 6p. (ASTM-B-334-71).

This general specification covers corrosion- and heat-resistant alloy plate and sheet (composition: Ni–15 to 17% Mo–14.5 to 16.5% Cr) in the hot-rolled, annealed, and descaled condition. Testing, permissible variations in dimensions, mechanical properties, etc. are covered. (DLC)

32788 NICKEL–MOLYBDENUM–CHROMIUM ALLOY ROD. Philadelphia; American Society for Testing and Materials (1971). 5p. (ASTM-B-336-71).

This specification covers corrosion- and heat-resistant alloy (composition: Ni–15 to 17% Mo–14.5 to 16.5% Cr) rods in the two following conditions: hot-finished, annealed, and descaled, 5/16 to ¾ in. dia; hot-finished, annealed, and ground or turned, ¾ to 3½ in. dia. Sampling, mechanical properties, testing, dimensional variations, etc. are covered. (DLC)

32789 FORGED OR ROLLED CHROMIUM–NICKEL–IRON–MOLYBDENUM–COPPER–COLUMBIUM STABILIZED ALLOY PIPE FLANGES, FORGED FITTINGS, AND VALVES AND PARTS FOR CORROSIVE HIGH-TEMPERATURE SERVICE. Philadelphia; American Society for Testing and Materials (1970). 5p. (ASTM-B-462-70).

This standard specification covers forged or rolled components of composition 19 to 21% Cr, 32 to 38% Ni, remainder Fe, 2 to 3% Mo, 3 to 4% Cu, and 0.56 to 1% Nb + Ta. Fabrication, heat treatment, composition, mechanical properties, testing, etc. are covered. (DLC)

32790 NICKEL–CHROMIUM–MOLYBDENUM–COLUMBIUM ALLOY PLATE, SHEET, AND STRIP. Philadelphia; American Society for Testing and Materials (1972). 11p. (ASTM-B-443-72).

This general standard specification covers rolled Ni–20-23 Cr–8-10 Mo–3.15-4.15 Nb (+Ta) alloy plate, sheet, and strip, and general fabrication methods of drawing, forming, stamping, bending, joining, etc. Chemical composition, mechanical properties, permissible variations in dimensions, edges, sampling and testing, etc., are covered. (12 tables) (DLC)

32791 EFFECT OF RARE EARTHS ON THE STRUCTURE AND PROPERTIES OF STEELS Kh18N10T, Kh17N13M2T, AND 00Kh17N11. Pridantsev, M. V.; Ostapenko, T. V. Izv. Akad. Nauk SSSR, Metal.; No. 3, 136-140(1974). (In Russian).

The addition of rare earths to the subject steels modifies their cast structure. Since the modifying effect is due to the sulfides of the metals, the effect decreases with decrease in the

sulfur content of the steel. As a result of broadening of the equiaxis crystal zone, the α phase decreases; the amount and distribution of the crystals are determined by the strucutre of the ingot. The rare earths, acting on the intergranular zone, increase the hardness of steels Kh18N10T and Kh17N13M2T. The optimum rare earth addition (0.1%) increases the strength of the steel at elevated temperatures. (tr-auth)

32792 INFLUENCE OF PRECIPITATION HARDENING ON THE MECHANICAL PROPERTIES OF A Cr–Ni–Mo–Cu–Nb MARTENSITIC STAINLSS STEEL. Adamczyk, J.; Kozlowski, F.; Przybyl, M. (Umoenienia Stopow Metali, Gliwice, Poland). Z. Psychosom. Med.; No. 51, 91-109(1973). (In Polish).

32793 ON THE CONSTITUTION OF THE R-T-SYSTEMS (R = RARE EARTHS AND YTTRIUM, T = IRON, COBALT AND NICKEL). Khan, Y. (Bochum Univ. (F. R. Germany). Inst. fuer Werkstoffe der Elektrotechnik). Z. Metallk.; 65: No. 7, 489-495 (Jul 1974). (In German).

7 figs.; 1 tab.; 38 refs.

The T-rich part (66-100 at. % T) of the R-T systems can be divided into two distinct composition regions: one on the R-rich side of RT_5 (RT_{5-z}, $0 < z < = 3$) and one on the T-rich side (RT_{5+z}, $0 < z < = 3.5$). The phase formation in these two composition regions is described by two relations. The most important consequence of these structural results is that about the composition RT_5 a miscibility gap should exist in the R-T phase diagrams. The crystal structures of the RT_7 intermetallic compounds are one-dimensional long period superstructures of the $CaCu_5$-type. Their stability depends upon the valence electron concentration. The theoretical equilibrium phase diagram of the T-rich part of the R-T systems is presented. The experimentally determined phase diagrams of the systems yttrium–cobalt and samarium–cobalt are given. (GE)

32794 DIRECTIONALLY SOLIDIFIED COMPOSITES BASED ON THE TERNARY EUTECTIC Ni–Ni_3Al–Ni_3Ta (γ/γ'-delta). Mollard, F.; Lux, B.; Hubert, J. C. (Battelle-Centre de Recherche de Geneve (Switzerland)). Z. Metallk.; 65: No. 7, 461-468(Jul 1974).

14 figs.; 3 tabs.; 6 refs.

The microstructure of the ternary eutectic Ni–Ni_3Al–Ni_3Ta is described by comparison with that of the pseudo-binary Ni_3Al–Ni_3Ta eutectic alloy. The corresponding mechanical properties found at ambient and elevated temperature up to 1200°C are presented and compared with those of competitive alloys. In addition, indications are given for future developments which would make it possible for the ternary eutectic to exceed the operating limits of conventional, cast superalloys while retaining most of their favorable features in terms of simple and rapid production. (GE)

32795 PRECIPITATION OF THE ω-PHASE IN TITANIUM-MOLYBDENUM ALLOYS. Gysler, A.; Bunk, W.; Gerold, V. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e. V., Porz-Wahn (F. R. Germany). Inst. fuer Werkstoff-Forschung; Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Metallkunde). Z. Metallk.; 65: No. 6, 411-417(Jun 1974). (In German).

9 figs.; 1 tab.; 15 refs.

The precipitation of the metastable hexagonal π phase from the bcc β solid solution of three titanium–molybdenum alloys was investigated by x-ray diffraction and electron microscopy. In all alloys a metastable phase equilibrium between the β and π phases was established. At 350°C the equilibrium concentration of the π phase was approximately 3.4 at .% Mo. The equilibrium volume fraction of the ellipsoidal π particles ranged from 12 to 56 vol .% and was attained only after more than 200 h. Simultaneous particle coarsening caused the interparticle spacing to pass through a minimum as a function of annealing time. The different effects of vacancies and dislocations on the precipitation of the π phase were investigated. (GE)

32796 VACANCIES AND CHANGES OF PHYSICAL PROPERTIES OF METALS AT THE MELTING POINT. Gorecki, T. (Wyzsza Szkola Inzynierska, Opole (Poland). Physics Group). Z. Metallk.; 65: No. 6, 426-431(Jun 1974).

4 figs.; 3 tabs.; 59 refs.

The existence of hitherto unnoted correlations between the changes of some physical properties of metals at the melting point and the changes of the same physical properties caused by the formation of vacancies in metals is established. On the basis of these correlations the melting process can be interpreted as the formation of vacancies in the solid phase of metals at the cost of the heat of fusion. The vacancy concentration increases at the melting point by approximately $\Delta c = 10$ at.%. (GE)

32797 LANTHANIDES AND ACTINIDES. Mueller, W.; Maas, K. Chem.-Ztg., Chem. App.; 97: No. 10, 513-514(Oct 1973). (In German)

7 refs.

The lanthanides comprise the lanthanum and the following 14 elements of the periodic system, the actinides the actinium and the following 14 elements with atomic numbers from 89 to 103; nearly 30% of all known elements belong to them, they are representing more than one third of the metals. The actinide concept of Seaborg of the 5f-elements, other classifications such as "uranides" and "curides," the electronic structure and the chemistry of the lanthanides and actinides, and the differences made when considering the two families of elements are discussed in general. (GE)

32798 X-RAY INVESTIGATIONS OF THE INTERMETALLIC PHASES $CaCd_{1-x}Tl_x$ AND $CaIn_{1-x}Tl_x$ AND KNIGHT SHIFT MEASUREMENTS OF ^{205}Tl- AND ^{113}Cd-NMR IN THE SYSTEM $CaCd_{1-x}Tl_x$. Marcoll, J. D.; Schmidt, P. C.; Weiss, A. (Technische Univ. Darmstadt (F. R. Germany). Physikalische Chemie 3). Z. Naturforsch., a; 29: No. 3, 473-476(Mar 1974).

3 figs.; 3 tabs.; 15 refs.

The quasibinary systems $CaCd_{1-x}Tl_x$ and $CaIn_{1-x}Tl_x$ form continuous series of solid soultions for all concentrations x: $0 < = x < = 1$. All alloys of both systems crystallize with space group O_h^1 Pm3m and one formula unit per unit cell (CsCl-type structure). Considerable deviations from Vegard's law occur for $CaCd_{1-x}Tl_x$, while they are negligible for $CaIn_{1-x}Tl_x$. No sign for the appearance of superstructures was found in either system after equilibrating them at 300°C for two hours. In the system $CaCd_{1-x}Tl_x$ the Knight shift K_s of the ^{205}Tl- and ^{113}Cd-NMR was measured at room temperature as a function of x. Saturated $Tl(CH_3CO_2)$ and $Cd(NO_3)_2$ solutions served as reference samples. The Knight shift of the ^{205}Tl-resonance increases remarkably with increasing concentration x, whereas the Knight shift of the ^{113}Cd-NMR decreases slightly with increasing x. No simple qualitative explanation is found for $K_s Tl = f(x)$ and $K_s Cd = f(x)$. (auth)

32799 METALLOGRAPHY OF RARE EARTH-COBALT ALLOYS. P. 1. The Adherence of Swarf After Fine Grinding and Polishing. Feldmann, D. (Bochum Univ. (F. R. Germany). Inst. fuer Werkstoffe der Elektrotechnik). Prakt. Metallog.; 9: No. 7, 408-413(Jul 1974). (In German, English).

4 figs.; 4 refs.

In the surface cleaning after the individual stages of polishing of the magnetic rare earth-cobalt alloys, there in the danger of scratching as a result of coarse swarf particles adhering to the surface. It is shown that (1) swarf particles persist in spite of ultrasonic cleaning and can thus lead to scratching; (2) by deliberately utilizing the swarf as a Bitter solution the magnetic domain structure of a material can be recognized at a very early stage and used to assess the magnetic anisotropy. (GE)

32800 BINARY SYSTEMS INVOLVING THE CATATECTIC REACTION SOLID 1 (COOLING) → SOLID 2 + LIQUID (HEATING) → SOLID 1. Wagner, S. (Bell Telephone Labs., Holmdel, NJ); Rigney, D. A. Met. Trans.; 5: No. 10, 2155-2160(Oct 1974).

The name "catatectic" is proposed for the reaction solid 1 (cooling) → solid 2 + liquid (heating) → solid 1, and a simple thermodynamic analysis is presented to aid in predicting the existence of this feature in binary phase diagrams. In addition, a survey of available phase diagrams shows that the reaction may occur much more commonly than has been suspected. (3 tables, 11 references) (auth)

32801 INTERDIFFUSION IN THE Ni/TD–NiCr and Cr/TD–NiCr SYSTEMS. Pawar, A. V.; Tenney, D. R. (Virginia Polytechnic Inst. and State Univ., Blacksburg). Met. Trans.; 5: No. 10, 2139-2143(Oct 1974).

The diffusion of Ni and Cr into TD–NiCr was studied over the 900 to 1100°C temperature range. The diffusion couples were prepared by electroplating Cr and Ni on polished TD–NiCr wafers. Concentration profiles produced as a result of isothermal diffusion at 905, 1000, and 1100°C were determined by electron microprobe analysis. The Boltzmann–Matano analysis was used to determine concentration-dependent diffusion coefficients which were found to compare favorably with previously reported values. These data suggest that 2 vol % ThO_2 distribution has no appreciable effect on the rates of diffusion in TD–NiCr with a large grain size. This supports the view that an inert dispersoid in an alloy matrix. will not in itself lead to enhanced diffusion unless a short-circuit diffusion structure is stabilized. (7 figs.) (auth)

32802 APPARENT ACTIVATION ENERGY FOR SERRATED YIELDING IN Cu–Be ALLOYS. Jovanovic, M. (Boris Kidric Inst. of Nuclear Sciences, Belgrade); Drobnjak, D. Scr. Met.; 8: No. 10, 1127-1134(Oct 1974).

The purpose is to supplement experimental data (Scr. Met. 7: 997 (1973)) on Cu–1, 1.5, and 2 wt % Be alloys and to show that the apparent activation energies found for serrated yielding are comparable to these for G. P. zone formation. The identity of the diffusion species is discussed, and it is concluded that the content of solute atoms affects the type of complexes which control the process. (DLC)

32803 TEMPERATURE DEPENDENCE OF THE MAGNETIC HYPERFINE FIELD AT ^{111}Cd IN MAGNETICALLY ORDERED HOLMIUM. Forker, M.; Fechner, J. B. (Univ., Bonn). Phys. Status Solidi (b); 65: No. 1, K9-K12(1 Sep 1974).

Time differential perturbed angular correlation was used, and the ^{111}Cd impurity content was less than 10^{-3} at. %. The spectrum indicates that the Cd impurities occupy two different types of lattice sites in Ho, with differing magnetic hf fields (159(3) and 139(3) kG at 4.2°K). The temperature dependence of both fields was studied at 4.2 to 132°K(T_N). Results indicate that the spin polarization of the conduction electrons at the Cd site decreases more strongly with temperature than the host magnetization. (DLC)

32804 PROPERTIES OF HIGH TEMPERATURE SOLID SOLUTIONS OF HAFNIUM OXIDE AND LANTHANIDE OXIDES. Duran, P. (Instituto de Ceramica y Vidrio, Madrid). Bull. Soc. Fr. Ceram.; No. 102, 47-55(Jan 1974). (In French).

Properties of high-temperature solid solutions (>2000°C) in the systems $HfO_2-Ln_2O_3$ (Ln = La, Nd, Sm, Gd, Y, Yb) were studied by x-ray diffraction. The oxides of the lanthanides dissolve in hafnium oxide and give a cubic solid solution of the fluorite type (C_1). In the region rich in Ln_2O_3, the dissolving of HfO_2 forms a centered cubic solid solution of the type Tl_2O_3. The formation of this solid solution is more rapid when the dimensions of the substituted Ln^{3+} ions is nearer to that of hafnium. In the case of the system $HfO_2-La_2O_3$, this solid solution does not form. The centered cubic solid solution of the type Tl_2O_3 (C_2) evolves in a continuous fashion towards a cubic structure with centered faces of the fluorite type only in the systems $HfO_2-Y_2O_3$ and $HfO_2-Yb_2O_3$. For all the other systems studied, an intermediate phase appears: the corresponding hafnate which is stable up to melting. (FR)

32805 FRACTURE TOUGHNESS AND FATIGUE CRACK GROWTH RATE PROPERTIES OF A Ni–Cr–Mo–V STEEL SENSITIVE TO TEMPER EMBRITTLEMENT. Begley, J. A.; Toolin, P. R. (Westinghouse Research Labs., Pittsburgh). Int. J. Fracture; 9: 243-253(Sep 1973).

Fracture toughness and fatigue crack growth rate properties are presented for an intermediate-strength Ni–Cr–Mo–V steel. The material was obtained from a scrapped rotor forging known to be sensitive to temper embrittlement. Reported results are the unaged baseline data of an investigation of temper embrittlement in Ni–Cr–Mo–V steel from a quantitative fracture mechanics viewpoint. Fatigue crack growth rate properties did not vary drastically even at test temperatures up to 550°F. However, fracture toughness values increased sharply near room temperature, leveled off at 200°F, and then remained nearly constant up to 500°F. Such a distinct upper shelf behavior is the first noted for an intermediate-strength steel. Upper shelf K_{Ic} values were in agreement with the upper shelf Charpy bar correlation of Rolfe and Novak (1970). Observations are also presented on the variation of fractographic features with test temperature and their relation to measured fracture toughness properties. (auth)

32806 EXPLANATION OF THE MAGNETIC STRUCTURE OF Er_2Ni_7 WITH A POINT-CHARGE CRYSTAL FIELD MODEL. Yakinthos, J. K. (Democritos Nuclear Research Center, Athens); Rentzeperis, P. J. Phys. Status Solidi (b); 64: No. 2, 643-647 (1 Aug 1974).

The magnetic structure of the intermetallic compound Er_2Ni_7, predicted by Bertaut's macroscopic theory, is plausibly explained by a crystal field model. The Er ions occupy two sites with anisotropy directions perpendicular to each other. The exchange energy forces the moments to deviate from these directions and form a canted structure. (auth)

32807 CRYSTAL FIELD THEORY INTERPRETATION OF THE MAGNETIC SUSCEPTIBILITY OF $CdYb_2Se_4$ SPINEL. Pokrzywnicki, S. (Technical Univ., Wroclaw); Czopnik, A.; Wrobel, B.; Pawlak, L. Phys. Status Solidi (b); 64: No. 2, 685-688(1 Aug 1974).

The paramagnetic susceptibility of polycrystalline $CdYb_2Se_4$ spinel was measured between 4 and 300°K. The data are interpreted within the crystal field approximation and a correction is made taking into account exchange interactions. The energy levels and crystal field parameters b_4 and b_6 are calculated. (auth)

32808 FRACTURE SURFACE EXAMINATION BY SELECTED AREA ELECTRON CHANNELLING OF SINGLE CRYSTALS OF Mo AND 15 AT. % Re ALLOY. Davidson, D. L. (Southwest Research Inst., San Antonio, TX). J. Mater. Sci.; 9: No. 7, 1091-1098(Jul 1974).

Fracture surfaces of molybdenum single crystals deformed in simple shear between 10^{-3} and 163 s^{-1} and 148 to 425°K were examined using selected area electron channeling to determine the planes of fracture and to estimate the plasticity associated with fracture. These results are correlated with topographic observations and with prior crystal plasticity. Similar, but less extensive, investigation was also made on crystals of molybdenum–15 at. % rhenium. Brittle fracture on several planes besides the {001} is one of the findings; rhenium alloying alters the fracture plane. (auth)

32809 DEFECT-ACTIVATED FIRST ORDER RAMAN SCATTERING IN BORON IMPLANTED GaAs. Ushioda, S. (Univ. of California, Irvine). Solid State Commun.; 15: No. 2, 149-153 (15 Jul 1974).

First order Raman scattering has been observed from phonons with non-zero wave-vectors in boron implanted samples of GaAs. In addition to the sharp peaks due to the normally allowed TO and LO phonons at the Γ-point, a continuous spectrum extending between 20 cm^{-1} and the LO phonon frequency (292 cm^{-1}) is observed. The structures in this continuous spectrum can be closely correlated with those in the one-phonon density of states of pure GaAs, and the temperature dependence of its Raman scattering intensity shows that it is due to one phonon processes. It is concluded that the observed continuous spectrum is due to defect-activated first order Raman scattering. (auth)

32810 MEASUREMENTS OF QUENCHED-IN RESISTIVITY IN THIN SINGLE CRYSTAL TUNGSTEN WIRES. Koshnevisan, M.; Stone, E. L. III; Bass, J. (Michigan State Univ., East Lansing). Phil. Mag.; 30: No. 1, 105-113(Jul 1974).

The electrical resistivities of a series of thin polycrystal and single-crystal tungsten wires annealed and quenched in both ultra-high vacuum and superfluid helium have been measured. For a given sample the quenched-in resistivities were very nearly the same for both ultra-high vacuum and superfluid quenches. It is inferred from the result that the quenched-in resistivities are not due either to quenched-in helium atoms or to atmospheric contamination as recently suggested by Evans (Evans, J., 1970, Phil. Mag., 22, 1261). On the other hand, the magnitude of the quenched-in resistivity varied somewhat from sample to sample. Results of measurements with an optical pyrometer suggest that this variation is not due primarily to differences in temperature of the samples just prior to quenching. Analyzing both the data and other data recently published it is concluded that impurities must play an important, but not yet adequately understood, role in determining the magnitude of the resistivity retained in quenched tungsten. (auth)

32811 AUGER ELECTRON EMISSION FROM Be SURFACES. Maguire, H. G.; Augustus, P. D. (Plessey Co. Ltd., Towcester, Eng.). Phil. Mag.; 30: No. 1, 95-103(Jul 1974).

Auger spectra have been obtained from Be surfaces prepared under uhv conditions, by thermal cleaning, evaporation and by argon ion bombardment. The resulting Auger spectra from these variously prepared surfaces exhibit different peaks in the dN(E)/dE versus E spectrum which relate to modifications in the band structure. No evidence is found that the difference in the spectra is due to surface impurities. Oxidation effects on the clean Auger spectrum are in agreement with those obtained by others. The temperature variation in the Auger spectrum from clean Be surfaces is discussed in relation to previously reported x-ray investigations. (auth)

32812 STACKING FAULT ENERGY AND ITS INFLUENCE ON HIGH-TEMPERATURE PLASTIC FLOW IN Zr–Sn ALLOYS. Sastry, D. H.; Luton, M. J.; Jonas, J. J. (McGill Univ., Montreal). Phil. Mag.; 30: No. 1, 115-127(Jul 1974).

Deformed α-zirconium–tin alloys were studied by means of x-ray diffraction and the results were analyzed by the line-broadening method. Stacking fault probabilities were estimated and found to be 2.6, 5.6, 7.6, and 10×10^{-3} in zirconium containing 0, 0.7, 3, and 5 wt% tin, respectively. The results are used to show that the unpinning of attractive junctions is a plausible rate-controlling mechanism at high temperatures, as has been previously suggested. The model calls for the thermally-activable junction to be a few Burgers vectors long and for the strengthening associated with tin addition to be due to the enhanced stability of the attractive junctions which results from the observed decrease in stacking fault energy. The rate of high-temperature flow in zinc and cadmium and the strengthening of

zinc that accompanies the addition of cadmium are also shown to be consistent with this explanation. (auth)

32813 ANISOTROPIC EXCHANGE INTERACTION IN THE CONICAL MAGNETIC PHASE OF ERBIUM. Jensen, J. (Danish Atomic Energy Commission, Risoe). J. Phys., F (London); 4: No. 7, 1065-1072(Jul 1974).

From a general two ion spin Hamiltonian an expression is deduced for the energies of spin waves propagating in a hexagonal solid in which the magnetic moments are ordered in a conical or helical structure. The spin wave dispersion relation in the c direction of Er in its conical magnetic phase at 4.5°K, which has been studied by Nicklow et al. (Phys. Rev. Lett.; 27: 334 (1971)) is reanalyzed. In this analysis an alternative kind of anisotropic coupling is introduced between the total angular moments (J_i and J_j) on the sites i and j, proportional to the following combination of Racah operators: $O_{2,-2}(J_i)$, $O_{2,-2}(J_j)$, expressed with respect to a coordinate system with the z axis along the c direction. The resulting anisotropy (both the constant and the q dependent part) is reduced by an order of magnitude in comparison with that deduced by Nicklow et al. (1971). The constant anisotropy is found to be equal to about 20 MeV (a rough estimate from magnetization measurements gives 5 to 10 MeV). The anisotropic part of the exchange interaction is found to be of the same order of magnitude as the isotropic part. (auth)

32814 SIMULTANEOUS MEASUREMENTS OF HEAT CAPACITY, ELECTRIC RESISTIVITY, AND HEMISPHERICAL TOTAL EMITTANCE OF AN ALLOY OF NIOBIUM, TANTALUM, AND TUNGSTEN IN THE RANGE 1500 TO 2800 K. Cezairliyan, A. (National Bureau of Standards, Washington, DC). J. Chem. Thermodyn.; 6: No. 8, 735-742(Aug 1974).

Simultaneous measurements of the heat capacity, electric resistivity, and hemispherical total emittance of an alloy of niobium, tantalum, and tungsten (nominal composition: 80 mass percent Nb, 10 mass percent Ta, and 10 mass percent W) in the temperature range 1500 to 2800°K by a sub-second-duration transient technique are described. Estimated inaccuracies of measured properties are: 3 percent for heat capacity, 5 percent for hemispherical total emittance, and 0.5 percent for electric resistivity. Properties of the alloy are compared with the properties of the constituent elements. The measured heat capacities are approximately 2.6 percent (on the average) higher than the values computed according to Kopp's additivity law. Although this difference is within the combined estimated inaccuracies, it is higher than the combined estimated imprecision of the measurements. Therefore, the alloy probably departs from Kopp's law. The electric resistivities indicate a significant departure from Matthiessen's law. Like the major constituent niobium, the alloy showed a negative departure from linearity in the plot of electric resistivity against temperature. (auth)

32815 BULK MAGNETIC ANISOTROPY CONSTANTS OF THE RARE-EARTH IRON LAVES COMPOUNDS. Dariel, M. P.; Atzmony, U. (Israel Atomic Energy Commission, Beersheba). Int. J. Magn.; 4: No. 3, 213-218(1973).

The one-ion model gives a satisfactory account of the magnetic anisotropy properties of the rare-earth iron Laves compounds. Calculated values of the bulk anisotropy constants K_1 and K_2, in the temperature interval 4.4 to 300°K, are presented for the RFe_2 compounds R = Tb, Dy, Ho, Er, and Tm. (auth)

32816 MAGNETIC ANISOTROPY IN THE $Th(Co_{1-x}Fe_x)_5$ AND $Y(Co_{1-x}Fe_x)_5$ SYSTEMS. Rothwarf, F. (Army Electronics Labs., Fort Monmouth, NJ); Leupold, H. A.; Greedan, J.; Wallace, W. E.; Das, D. K. Int. J. Magn.; 4: No. 3, 267-271(1973).

Magnetization measurements were made at room temperature on $ThCo_5$ and YCo_5 and on the ternaries $Th(Co_{1-x}Fe_x)_5$ and $Y(Co_{1-x}Fe_x)_5$ in the form of aligned powders with the field directed along the easy and hard magnetic directions. The field was varied from −100 to +100 kOe. The anisotropy fields (H_A) are found to be 160 and 120 kOe for $ThCo_5$ and YCo_5, respectively. Replacement of one Co by Fe in the RCo_5 materials leaves H_A unaffected. Further introduction of Fe results in a sharp decrease in H_A. These results seem to indicate that Co in the 2c sites, which lie in the plane containing the R atoms, is crucial for the large magnetic anisotropy of the RCo_5 compounds. The experimental results are consistent with the notion that Fe substitutes for Co preferentially at the 2c sites and that the occupation of these sites by cobalt is critical in establishing the large anisotropy and remanence. The results suggest that the system $Th(Co_{1-x}Fe_x)_5$ will exhibit the strong magnetic anisotropy as long as half of the 2c sites are occupied by cobalt and will continue to exhibit an increasing remanence until all the 2c sites have been replaced by iron. For the $Y(Co_{1-x}Fe_x)_5$ system the corresponding fractions of the 2c sites requiring substitution of iron for cobalt to produce anisotropy and remanence changes are one-quarter and one-half. $ThCo_3Fe_2$ behaves in an anomalous fashion. Its anisotropy measured at relatively low fields, disappears upon cooling to 4.2°K. The anisotropy does not reappear immediately when the sample is warmed to room temperature. It does reappear if the sample is held at room temperature for several days. (auth)

32817 PHASE COMPOSITION OF MARTENSITE-AGING STEELS BASED ON COMPOSITION 00N18K9M5. Spiridonov, V. B.; Kuz'minskaya, L. N.; Makarovets, O. D.; Sosulina, I. A. Fiz. Metal. Metalloved.; 37: No. 4, 850-856(Apr 1974). (In Russian).

A study of the separating phases of martensite-aging steels (both the primary phases present after hardening and the secondary phases formed in aging) was made using x-ray phase analysis, electron microscopy and electron diffraction of replicas with fixed particles, electron microscopy and electron diffraction of metal foils, including the use of the dark field. Results indicate that the phases responsible for hardening during aging in 00N18K9M5T steel are Ni_3Ti and Fe_2Mo, in 00N18K9M5 and 0Kh12K10M6 steels are Fe_2Mo, and in 00Kh11N10M2T steel are Ni_3Ti. The primary phases in 00N18K9M5 steel are Fe_3Mo_3C and possibly Ni_3Mo, in 00N18K9M5T steel TiC, TiN, τ-Ti_2S, ϵ-Fe_3Mo_2, Fe_2Mo, and possibly Ni_3Mo, Mo_2C, Fe_3Mo_3C, and AlN. (JPRS)

32818 STRUCTURE OF SPLAT-COOLED Fe−20% Cr−25% Ni AUSTENITIC STEEL. Wood, J. V.; Honeycombe, R. W. K. (Cambridge Univ., Eng.). J. Mater. Sci.; 9: No. 7, 1183-1188 (Jul 1974).

A controlled atmosphere splat quenching gun has been used to produce splats of Fe−20% Cr−25% Ni. Three types of structure were observed by thin foil electron microscopy, namely high-angle cellular, low-angle cellular, and linear arrays of dislocation loops, which were determined primarily by the heat transfer conditions. In the thin, most rapidly cooled areas (lift-off regions) high-angle cellular structures were observed which were largely free of defects. As the cooling rate decreases there was a greater tendency for low-angle cellular structures to form, but at intermediate cooling rates bands of dislocation loops were observed. These are explained in terms of solute segregation and vacancy coalescence along ⟨100⟩ directions in the austenite. (auth)

32819 DIRECTIONAL COUPLED GROWTH OF A MODIFIED INCONEL 713C ALLOY. Bhambri, A. K.; Kattamis, T. Z. (Univ. of Connecticut, Storrs). J. Mater. Sci.; 9: No. 7, 1213-1216(Jul 1974).

The morphology of MC carbide obtained by directional solidification of eutectic systems has been investigated previously. Walter et al. (Compt. Rend. Acad. Sci., Paris; 1: 61 (1973)) in their work used hypereutectic compositions in order to produce both primary faceted crystals and fibers of TaC within the same ingot. The main purpose of the investigation now reported was to extend these morphological studies to more complex systems and to explore the dependence of growth morphology of the carbide on growth conditions in a eutectic system consisting of a polynary matrix and a polynary carbide phase. An alloy was prepared by modifying an Inconel 713C alloy with a masteralloy containing 68.5 wt% (Nb + Ta), 17.2 wt% Ti and 14.3 wt% C. The preparation of the samples is described. Examination was metallographic and by scanning electron microscopy. Results are presented. (UK)

32820 INVESTIGATION OF THE La−Ge SYSTEM. Nasibov, I. O.; Alieva, M. M.; Rustamov, P. G. Azerb. Khim. Zh.; No. 5-6, 143-148(1973). (In Russian).

On the basis of results of physico-chemical analyses, a phase diagram of the La−Ge system was given. Four chemical compounds exist in the system of which one LaGe is a congruently melting compound. The other three La_5Ge_3, La_4Ge_3, and $LaGe_2$ are incongruent. It was established that LaGe and $LaGe_2$ have polymorphic transformations at 680 and 825 for the first compound and 480 and 790°C for the second. (tr-auth)

32821 RADIATION-GENERATED PRISMATIC LOOPS AROUND GAS BUBBLES IN ALUMINUM−LITHIUM ALLOY. Shiraishi, K.; Hishinuma, A.; Katano, Y. (Japan Atomic Energy Inst., Tokai). Radiat. Eff.; 21: No. 3, 161-164(Mar 1974).

Prismatic dislocation loops were observed to emanate from a gas bubble in neutron-irradiated aluminum−lithium alloy during electron irradiation at 200°C in a 200 kV electron microscope. The loops aligned in the ⟨110⟩ directions were analyzed to be vacancy loops on {111} plane with a/2 ⟨110⟩ Burgers vector. In a 1000 kV electron microscope, the prismatic punching loops were observed to occur during electron irradiation at 50°C. The prismatic loops were considered to nucleate at the surface of a

gas bubble by condensation of radiation-produced vacancies and to propagate in the ⟨110⟩ directions by pencil glide under vacancy supersaturated environment. (auth)

32822 THERMAL ANALYSIS OF THE In–Pb–Bi SYSTEM. Stel'makh, S. I.; Tsimmergakl, V. A.; Sheka, I. A. (Inst. of General and Inorganic Chemistry, Kiev). Ukr. Khim. Zh.; 40: No. 7, 762-764(Jul 1974). (In Russian).

Alloys of the quasi-ternary system In–Pb–InBi were studied by differential thermal analysis. Phase diagrams were constructed along its polythermal cross section and on the basis of an analysis of the boundary binary diagrams. A phase diagram of the general system In–Pb–In was constructed from these data and from the phase diagram of the In–Pb–InBi system obtained earlier. (tr-auth)

32823 CRYSTAL STRUCTURE OF Pu_5Ru_3, Pu_5Rh_3, Pu_5Os_3, Pu_5Ir_3, and Pu_5Pt_3. Beznosikova, A. V.; Chebotarev, N. T.; Luk'yanov, A. S.; Chernyi, A. V.; Smirnova, E. A. At.Energ. (USSR); 37: No. 2, 144-148(Aug 1974). (In Russian).

X-ray examination of single crystals showed that Pu_5Ru_3, Pu_5Os_3, and Pu_5Ir_3 are isostructural, belonging to the tetragonal system, space group I4/mcm, and structural type W_5Si_3. The dimensions of unit cells were determined to be as follows:

	a in Å	c in Å
Pu_5Ru_3	10.768 ± 0.005	5.474 ± 0.003
Pu_5Os_3	10.881 ± 0.008	5.664 ± 0.003
Pu_5Ir_3	11.043 ± 0.008	5.611 ± 0.005

Pu_5Rh_3 has a tetragonal unit cell, space group P4/ncc with dimensions: a = 10.94 ± 0.01, c = 6.020 ± 0.003 Å, z = 4. Pu_5Pt_3 has a hexagonal unit cell, space group $P6_3/mcm$, structural type Mn_5Si_3, unit cell dimensions: a = 8.490 ± 0.005, c = 6.094 ± 0.004 Å, z = 2. Atomic parameters, coordination of atoms and interatomic distances in these structures are calculated. (auth)

32824 EFFECT OF RESIDUAL POROSITY ON PROPERTIES OF TUNGSTEN–COBALT HARD ALLOYS. Romanova, N. I.; Kreimer, G. S.; Tumanov, V. I. (All-Union Scientific-Research Inst. of Refractory Metals and Hard Alloys, Moscow). Porosh. Met., Akad. Nauk Ukr. SSR; No. 8, 84-89(Aug 1974). (In Russian).

Changes in some physical and main mechanical properties of the hard alloy BK8 were studied as dependent on the change in the volumetric content and pore size within the range from the conventional zero porosity to 1 vol.%. It is shown that transverse bending strength, fatigue durability at cyclic bend, ultimate strength, yield limit in pressing out, hardness, and impact strength fall with an increase in porosity according to the exponential law, i.e. the fall is particularly pronounced in the domain of low porosity. (auth)

32825 EFFECT OF THE RARE EARTH METALS ON THE STRUCTURE AND PROPERTIES OF CHROMIUM. Rakitskii, A. N.; Trefilov, V. I. (Inst. of Metal Physics, Kiev). Metallofizika; No. 51, 97-105(1974). (In Russian).

Results of the study of the structure and properties of alloys of Cr with Sc, Y, La, Ce, Pr, Nd, Sm, Gd, Tb, Ho, Dy, Er, and Lu in the cast, deformed, and recrystallized states were reported. It was shown that the alloying of Cr with La and Pr is the most promising from the viewpoint of low-temperature ductility. The optimum content of rare earth metals in Cr varied from 0.4 to 0.7 wt.%. Bars, wires, foils, and sheets with transition temperature to the brittle state from -80 to -170°C were obtained from Cr–La and Cr–Pr alloys by thermomechanical processing. (tr-auth)

32826 MAGNETIC PROPERTIES OF THE ALLOY Co–19.6 wt. % W DURING QUENCHING AND ANNEALING. Efimova, T. V.; Polotnyuk, V. V.; Shmatko, O. A. (Inst. of Metal Physics, Kiev). Metallofizika; No. 51, 81-84(1974). (In Russian).

The temperature dependence of the magnetization I from 20 to 950°C was studied by magnetomechanical methods in a field of 3 kOe after quenching the sample from different temperatures (1470 to 700°C) and annealing at 950°C. An increase of I and a decrease of the Curie point θ_C of the annealed samples (θ_C = 800°C) was observed in comparison with samples quenched above 700°C (θ_C = 900°C). Samples quenched from 1100°C were annealed at 700°C for 5, 12, 18, and 26 hrs. The magnetic characteristics of the annealed samples (I(T), θ_C, coercive force, and residual magnetization), measured as a function of time, were changed discontinuously. The results obtained led to the conclusion that ordering is possible in this alloy. The ordered metastable phase would be $Co_{18}W$. (tr-auth)

32827 EFFECT OF NICKEL ON THE STRUCTURE AND PROPERTIES OF ALLOYS OF THE Mo–Zr–C SYSTEM IN THE RECRYSTALLIZED STATE. Biryukova, T. A.; Kotko, V. A.; Trefilov, V. I.; Firstov, S. A.; Shchukin, A. A. (Inst. of Metal Physics, Kiev). Metallofizika; No. 51, 63-68(1974). (In Russian).

The structural changes during annealing of Mo alloys containing 0.2 to 0.25% Zr and 0.02 to 0.04% C and additionally alloyed with 0.03 to 0.05% Ni were studied. It was shown that with increase of the annealing temperature in the Mo–Zr–C alloys, changes were observed in the electron microscopic images of the grain boundaries at 1200 to 1400°C. Such a strong diffuse contrast appeared that the usual striated contrast was almost invisible. With increase of the annealing temperature and formation of the boundary precipitates, the normal striated contrast was reduced. In Mo–Zr–Ni–C alloys up to temperatures of 1800°C, the contrast at the grain boundaries remains normal. The formation of flat boundary precipitates in Mo–Zr–C alloys was promoted by the preservation of grains stretched along the direction of the rolling, whereas in Mo–Zr–Ni–C alloys at the same annealing temperature the grain has an equiaxial form and flat precipitates are not observed. The decrease of the plasticity of the Mo–Zr–C alloys occurs at annealing temperatures about 200°C lower than in the Mo–Zr–Ni–C alloys. (tr-auth)

32828 STRUCTURE AND PROPERTIES OF V–Ge ALLOYS. Savitskii, E. M.; Efimov, Yu. V.; Aikhler, K.; Zvolinskii, O. I. Izv. Akad. Nauk SSSR, Metal.; No. 3, 214-220(1974). (In Russian).

The phase diagram was constructed from microscopic, x-ray, differential thermal analyses, microhardness, and T_c. Formation of V_3Ge, V_5Ge_3, $V_{11}Ge_8$, and $V_{17}Ge_{31}$ was confirmed. V_3Ge with cubic structure of type A-15 and V_5Ge_3 with W_5Si_3-type tetragonal structure melt congruently at 1690 ± 10 and ~1930°C respectively. At high temperatures, V_3Ge (> 800°C) and V_5Ge_3 (≳1500°C) have a narrow region of homogeneity: from 24 to 27 at. % Ge at 1590 to 1620°C for the first and from 36.9 to 37.5 at. % Ge at 1620°C for the second. The composition of V_3Ge at temperatures below 800°C shifts from the stoichiometric composition to the side of very high V concentration (24.5 to 24.9 at. % Ge); its fusion maximum is at 25 at. % Ge. The compounds $V_{11}Ge_8$ and $V_{17}Ge_{31}$ are formed by peritectic reactions at 1575 ± 10 and 960 ± 5°C respectively and have a constant composition. Three eutectics were established in the system: a solid solution based on V + V_3Ge at 1590 ± 15°C and ~15 at. % Ge, V_3Ge + V_5Ge_3 at 1620 ± 15°C and ~ 31 at. % Ge, and $V_{17}Ge_{31}$ + Ge-based solid solution at 927 ± 3°C and ~98 at. % Ge. The solubility of Ge in the V increases with temperature and is at least 0.5 at. % at temperatures below 600°C, 1 at. % at 800°C, 1.8 at. % at 1200°C and 3 at. % at the eutectic temperature. The solubility of V in Ge is small and clearly does not exceed several tenths at. %. At temperatures above 4.2°K only the V-based solid solution and V_3Ge have superconducting properties. Ge, dissolved in V, descreased its T_c from 5.3 to 3.7°K (at saturation). The T_c of V_3Ge after annealing at 800°C is 6.0 to 6.3°K (the maximum value corresponds to the one-phase state). T_c of the compounds is increased with the quenching temperature. T_c was determined as 6.4 to 7.5°K. Cooling of the alloys with 25 to 27 at. % Ge at a high rate was not possible because of the sudden cracking found with a variety of the samples. The pattern of the change of T_c of rapidly cooled alloys as a function of their composition showed that these alloys should have maximum transition temperatures. (tr-auth)

32829 INELASTIC NEUTRON SCATTERING FROM AMORPHOUS GERMANIUM. Axe, J. D. (Brookhaven National Lab., Upton, NY); Keating, D. T.; Cargill, G. S. III; Alben, R. AIP (Amer. Inst. Phys.) Conf. Proc.; No. 20, 279-283(1974).

From international conference on tetrahedrally bonded amorphous semiconductors; Yorktown Heights, New York, USA (20 Mar 1974). See CONF-740313-.

Inelastic neutron scattering was used to study vibrational spectra of amorphous Ge. Preliminary results on a 5-g sample of evaporated Ge indicate that the lowest energy peak in the density of states is broadened, and its center of gravity is shifted to somewhat lower energy than the corresponding TA phonon peak in the crystalline density of states. (DLC)

32830 KINETICS OF NITRIDE FORMATION IN LEVITATED MOLTEN IRON ALLOYS. Aguirre, C. E. Pittsburgh; Carnegie-Mellon Univ. (1974). 222p. University Microfilms Order No. 74-20,363.

Thesis (Ph.D.).

The kinetics of VN and ZrN precipitation in Fe–V, Fe–Zr and Fe–V–Zr alloys reacted with nitrogen at various temperatures in the range 1600 to 1635°C is determined by the levitation melting and splat cooling techniques. Both VN and ZrN are found to be stoichiometric. An analysis of the experimental data indicates that the VN precipitation is controlled by a solid-liquid interface mech-

anism, while the ZrN precipitation is controlled by nitrogen transport at the gas-metal interface. Homogeneous nucleation of the precipitates within the melt is not operative. A model of heterogeneous nucleation on the specimen gas-liquid interface is used to explain the precipitation at the early stages of the reaction. An atomistic crystallization model is developed to account for the growth rate time dependence of VN. Surface diffusion of adsorbed atoms on the VN crystal terraces toward kink double sites is identified as the elementary controlling reaction step. A simplified model of nitrogen grain boundary enhanced diffusion through a solid ZrN surface layer is used to explain the slow kinetics associated with ZrN formation. The precipitation of VN in the ternary Fe–V–Zr system is found to be independent of the ZrN reaction, but some interference phenomena are observed at the intermediate stages of the precipitation. The formation of a ZrN surface film is identified as the possible cause responsible for this interference Linear phenomenological relationships are observed close to equilibrium between the reaction rates and the reaction driving forces. The phenomenological coefficients $L_{V\text{-}V}$ and $L_{Zr\text{-}Zr}$ are determined but coupling effects are not identified in the VN–ZrN system. (Diss. Abstr. Int., B)

32831 DYNAMIC BEHAVIOR OF PARAMAGNETIC IONS AND CONDUCTION ELECTRONS IN INTERMETALLIC COMPOUNDS: $Gd_xLu_{1-x}Al_2$. Rettori, C.; (Univ. of California, Los Angeles); Kim, H. M.; Chock, E. P.; Dadidov, D. Phys. Rev., B; 10: No. 5, 1826-1835(1 Sep 1974).

Electron-spin resonance of Gd in $Gd_xLu_{1-x}Al_2$ intermetallic compounds exhibits significant changes in the g shift and thermal broadening upon (i) varying the Gd concentration, (ii) adding a second nonmagnetic impurity Th, and (iii) varying the temperature. These behaviors indicate the presence of the "bottleneck" and "dynamic" effects in the relaxation mechanism. Results were analyzed using a recent band calculation. The q dependence of the exchange interaction and the spin-flip scattering rates of the conduction electrons caused by the Gd and Th impurities were extracted. The data are compared with previous results on isoelectronic systems $LaAl_2$ and YAl_2 doped with the same impurities. (7 fig, 34 references, 3 tables) (auth)

32832 MAGNETIC ANISOTROPY AND HYPERFINE INTERACTIONS IN $CeFe_2$, $GdFe_2$, AND $LuFe_2$. Atzmony, U.; Dariel, M. P. (Negev Nuclear Research Centre, Beersheba, Israel). Phys. Rev., B; 10: No. 5, 2060-2067(1 Sep 1974).

Moessbauer-effect measurements on ^{57}Fe were carried out on the cubic Laves compounds $CeFe_2$, $GdFe_2$, and $LuFe_2$ between 80 and 300°K. Analysis of the Moessbauer spectra allowed the determination of the easy axes of magnetization $\vec{n}$ in these compounds. In $CeFe_2$, $\vec{n}$ is parallel to the [100] direction up to 150°K; it then becomes of type [uuw] with an angle of inclination with respect to the [100] axis of 20°. Just below the Curie temperature at 230°K, this angle increases to 30°. In $GdFe_2$, $\vec{n}$ is parallel to the [100] direction at 80 and 300°K. In $LuFe_2$, $\vec{n}$ is of [uuw] type at 80 and 300°K. In terms of the phenomenological treatment of the magnetic anisotropy, the presence of an [uuw] type of easy axis of magnetization indicates that the bulk magnetic-anisotropy constant K_3 is of the same order of magnitude as K_1 and K_2. The hyperfine parameters of the three compounds are reported and discussed. (9 fig) (auth)

32833 MAGNETIC EFFECTS OF LONG-RANGE ORDERING IN AN IRON–COBALT 2 PCT VANADIUM ALLOY. Thornburg, D. R.; Colling, D. A. (Westinghouse Research Labs., Pittsburgh). Met. Trans.; 5: No. 10, 2241-2242(Oct 1974).

Coercive force was measured to study long-range order in FeCo–2 V. Yield strength and elongation were also measured and correlated with the transition at 710°C (T_c). (DLC)

32834 STUDY OF THE ELECTRICAL CONDUCTIVITY OF LIQUID METALS. Banchila, S. N.; Filippov, L. P. (Moscow State Univ.). High Temp. (USSR) (Engl. Transl.); 11: No. 6, 1166-1169(1973).

Translated from Teplofiz. Vys. Temp.; 11: No. 6, 1301-1305 (1973).

Electrical conductivity measurements were made for the following liquid metals: Pb, Tl, Sn, In, Ga, Cu, La, Ce, Pr, Nd, and Dy. The electrical resistivity measurements on the rare earths cover the liquid phase and part of the solid phase. A distinguishing feature of the behavior of the rare-earth metals is the relatively small change in specific resistivity on melting. The sudden change (increase) in resistivity at the melting point diminishes regularly with increase in the atomic number of the element from 14% for La to 4% for Dy. The results obtained for the electrical resistivity of cerium agree with other investigations within 4%. In the case of La, Ce, Pr, and Nd there is agreement within about 5%. In discussing the results obtained, particular attention has been paid to the dependence of the electrical conductivity on density, there being grounds for supposing that the relationship between these variables may reveal interesting features. Indeed, a direct consideration of the relation between the specific resistivity and the molecular volume shows a fairly clear dependence, the curves for different metals forming a single-parameter family. Some relationships of this kind have already been discussed by A. M. Solov'ev (6). The existence of a single relationship embracing a wide range of liquid metals provides evidence of the important part played by the free volume in electron-transfer processes. (auth)

32835 MAGNETIC FOCUSING OF ELECTRONS AND HOLES IN BISMUTH. Clarke, J.; Schwartzkopf, L. A. (Univ. of California, Berkeley). J. Low Temp. Phys.; 16: No. 3-4, 317-335 (Aug 1974).

The electron and hole focusing effects in a magnetic field predicted by Pippard have been observed in bismuth. Two interlocking superconducting combs were evaporated onto the surface of a bismuth single crystal. The resistance R(H) between the combs was measured with a superconducting voltmeter as a function of the magnetic field H applied parallel to the teeth of the combs. A local minimum in the resistance was observed when the magnetic field focused electrons or holes in extremal orbits between the teeth of different combs. A similar effect was observed when the combs were replaced by two parallel superconducting strips. In this case the dependence of R(H) on H was in good qualitative agreement with the calculation of Gonçalves da Silva on a model whose Fermi surface was topologically equivalent to that of bismuth. From the values of H at which the minima occurred we have deduced estimates for D_{xe} and D_{ze}, the diameters of the principal electron ellipsoid along the binary and trigonal axes. We find $D_{xe} = (0.94 \pm 0.03) \times 10^{-2}$ Å^{-1} and $D_{ze} = (1.35 \pm 0.04) \times 10^{-2}$ Å^{-1}. These values lie somewhat below other values in the literature. This discrepancy may occur because each minimum in R(H) occurs at a field slightly below H_0, where H_0 is the field for which the diameter of the extremal electron trajectory is equal to the separation of the superconducting strips. (auth)

32836 OSCILLATORY MAGNETOSTRICTION AND THE STRESS DEPENDENCE OF THE FERMI SURFACE OF ALUMINUM, INDIUM, ZINC, AND MAGNESIUM. Griessen, R.; Sorbello, R. S. (Eigenoessische Technische Hochschule, Zurich). J. Low Temp. Phys.; 16: No. 3-4, 237-289(Aug 1974).

Oscillatory magnetostriction and de Haas–van Alphen measurements have been made in aluminum, indium, zinc, and magnesium between 1.3 and 4.2 K and in magnetic fields up to 22 kOe. From these results the stress dependence of several orbits on the third band Fermi surfaces of aluminum and indium and some orbits on the Fermi surfaces of zinc and magnesium was determined. The experimental values are in agreement with the results of simple OPW (orthogonalized plane wave) calculations in which the stress dependence of the pseudopotential is obtained from the Heine–Abarenkov–Animalu form factor in a local screening approximation. Angular constancy was observed in the stress dependence of the orbits, and a model is presented to account for this. The possibility of stress-induced Lifshitz transitions is also discussed, and how the free-electron model should be used to predict changes in the Fermi surface under hydrostatic pressure and uniaxial stress is shown. (auth)

32837 LOW-TEMPERATURE HEAT CAPACITY AND THERMODYNAMIC FUNCTIONS OF UBe_{13}. Samorukov, O. P.; Kostryukov, V. N.; Kostylev, F. A.; Tumbakov, V. A. At. Energ. (USSR); 37: No. 1, 28-31(Jul 1974). (In Russian).

The heat capacity was measured in the range 13.5 to 303.4°K using a vacuum adiabatic calorimeter. Values of the thermodynamic functions of uranium beryllide were calculated and tabulated at 10° intervals in the range 0 to 300°K. (auth)

32838 STUDY OF ELECTRONIC STRUCTURE IN INDIUM–CADMIUM ALLOYS WITH DTA. Luova, D. P. (Univ. of Turku, Finland). pp 68-73 of Symposium on Thermal Analysis. Zichichi, A. (ed.). Stockholm; Scandinavian Council for Applied Research (1973).

From 2nd Nordic symposium on thermal analysis; Riso, Denmark (13 Sep 1973). See CONF-7309114-.

DTA with electrical calibration was used to measure the heats of freezing for alpha-phase alloys of indium–cadmium system in the composition range 1.7 to 2.5 at. % cadmium. Electron-lattice interaction has been reported to cause changes in several physical properties at about 2 at. % cadmium (Brillouin zone effects). Measurements have revealed both a sharp minimum and a sharp maxi-

mum at 1.94 at. % cadmium, between which the rise in the heat of freezing is 170 joules per gram-atom. Heat of mixing in the solid phase is calculated, the variation of which can be interpreted in terms of changes in the distribution of Fermi surface in various Brillouin zones. (auth)

32839 GAMMA-RESONANCE SPECTROSCOPY. From Prof. Moessbauer's Lecture. Kamimura, H. (Tokyo Univ.). Radioisotopes (Tokyo); 23: No. 2, 126-131(Feb 1974). (In Japanese).

This paper summarizes the lecture given by Prof. Mössbauer; however, the description is limited to the present status of gamma-resonance spectroscopy. The method is based on the Mössbauer effect, which means sharp resonance absorption of gamma rays in the case of nuclei bound strongly in a solid. An example of the apparatus to measure the effect is illustrated. The f factor, which expresses the intensity of a recoil-less spectral line, approaches one when the temperature drops. Therefore, an experiment on the Mössbauer effect is usually performed at low temperature. Gamma sources used are low-energy gamma emitters, such as ^{181}Ta or ^{57}Fe. Gamma-resonance spectroscopy is applied to the studies of the hyperfine structure of atoms and impurities in metals. The types of hyperfine structure are the magnetic interaction between nuclear magnetic moment and magnetic field owing to magnetic substances, the electric quadrupole interaction between nuclear quadrupole moment and electric field in crystals, and the electrostatic interaction between nuclear charge and the electrostatic field owing to electrons. The nuclear isomer shift is one of the electrostatic interactions, and is caused by finite nuclear size. When the chemical forms of a gamma emitter and an absorber are different from each other, a difference is seen between the electron distribution in the nuclei of the emitter and the absorber. This difference can be observed with the Mössbauer effect, and gives information concerning the outermost-shell electrons in compounds. Impurities in metals are also investigated by the Mössbauer effect. (JA)

32840 B-Al COMPOSITE FAILURE UNDER COMBINED TORSION AND TENSION LOADING. Saint-John, C. F.; Street, K. N. (Ecole Des Mines de Paris, Corbeil-Essonnes, France). J. Compos. Mater.; 8: No. 3, 266-274(Jul 1974).

An experimental investigation was made regarding the effect of combined torsion and tension loading on the fracture characteristics of an aluminum matrix, unidirectional boron fiber reinforced composite. Three types of loading path were considered. The experiments were performed on notched specimens thereby allowing the fracture behavior to be tentatively interpreted in terms of linear elastic fracture mechanics. The combined mode fracture loads did not appear to obey a constant energy of fracture criterion. This conclusion is supported by a substantial difference in fracture surface morphology for pure tension and pure torsion loading. However, the lack of agreement between theory and experiment may be due to data reduction errors caused by the tendency for stable crack growth and plastic shear between the fiber and matrix to increase as the ratio of torsion to tension loading is increased. The fracture loads were found also to be loading path dependent with radial loading being the most severe. (auth)

32841 RARE GAS COMPLEXES IN TUNGSTEN. Wilson, W. D.; Bisson, C. L. (Sandia Labs., Livermore, CA). Radiat. Eff.; 22: No. 1, 63-66(May 1974).

Specific helium-tungsten defect configurations suggested by Kornelsen (Radiation Effects; 13:227(1972)) to result from ion implantation following irradiation were calculated. The calculations are atomistic in nature; those interatomic potentials involving the rare gases were determined from first principles. The divacancy is found to be most stable in the second-neighbor configuration in the pure W lattice, but energetically prefers first-neighbors if it contains a Kr atom. Good agreement is obtained with the experimental activation energies although certain configurations are found to differ slightly from those suggested by Kornelsen. (auth)

Radiation Effects

Refer also to abstracts 33929, 34245, and 34378.

32842 (AD-778652) IMPROVED FRACTURE TOUGHNESS OF TITANIUM. Final Report. Demay, S. (Grumman Aircraft Engineering Corp., Bethpage, N. Y. (USA)). Jun 1973. Contract N62269-73-C-0127. 43p. NTIS $5.25.

A comprehensive evaluation was conducted to (A) develop a heat-treat cycle which will improve the fracture toughness of Ti-6Al-6V-2Sn without markedly affecting its other properties and (B) verify that the "recrystallization anneal" cycle developed for Ti-6Al-4V rolled plate will also improve the fracture toughness of Ti-6-4 die forgings. The program included tensile, fracture toughness, stress-corrosion, and fatigue tests. (auth)

32843 (AT-AEC-13135) ATOM DISPLACEMENTS AND VOID FORMATION IN PROTON-IRRADIATED TYPE 316 STAINLESS STEEL. Keefer, D. W. (Atomics International Div., Canoga Park, Calif. (USA)). 30 Aug 1974. Contract AT(04-3)-824. 20p. Dep. NTIS $4.00.

Cross section for atomic displacement was calculated as a function of proton penetration into Type 316 stainless steel. The cross section at a given penetration is reduced from previous work, being the result of new information on proton range, modification of the cross-section calculations, and adoption of a higher displacement threshold energy. Swelling, void size, and void density data previously published are plotted against recalculated displacement damage. In general, the data are merely shifted to lower damage levels, and only one conclusion drawn in a previous publication (J. Nucl. Mat. 45: 55(1972)) appears to need modification. A short discussion on the effect of voids on proton energy and displacement cross section as a function of proton penetration is also included. (6 figures) (auth)

32844 (CONF-7309100-(Absts.)) COLLOQUIUM ON HYPERFINE INTERACTIONS DETECTED BY NUCLEAR RADIATION, LIEGE, BELGIUM, 11-13 September 1973. (Liege Univ. (Belgium)). 1973. 49p. (In French and English).

This volume is the program sent to participants of the joint meeting of the Belgian and French Physical Societies held September 11-13, 1973. It contains summaries of most of the papers presented; some are of abstract length, while a few run to several pages. Perturbed angular correlations, ion implantation, and Moessbauer spectroscopy are prominant. (RWR)

32845 (KFTI-73-26, pp 89-90) EXPERIMENTAL STUDY OF MECHANICAL STRESSES FOLLOWING THE INTERACTION OF RELATIVISTIC ELECTRONS AND SOLIDS. Armenskii, E. V.; Emel'yanov, V. K.; Rybin, V. M.; Tokarev, A. I.; Petrenko, V. V.; Fursov, G. L. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973). In nuclear science and engineering problems. Ser. High physics and nuclear physics.

The acoustic effect of the interaction of relativistic electron beams with aluminum and ceramic TsTS-19 plates was studied. The resulting mechanical tension was recorded piezometrically over a wide range of frequencies. The proportionality of the signal amplitude of the current density was shown. The dependence of the coefficient of conversion coefficient on the electron energy was found. (INIS)

32846 (ORO-3612-11) INVESTIGATION OF IRRADIATION STRENGTHENING OF B.C.C. METALS AND THEIR SOLID SOLUTIONS. Progress Report, January-October 1974. Arsenault, R. J. (Maryland Univ., College Park (USA)). 1974. Contract AT(40-1)-3612. 194p. Dep. NTIS $12.75.

Mechanisms of irradiation strengthening of bcc metals were studied. Results are reported in sections on deformation of low-temperature neutron irradiated V and Nb, effects of hydrogen on deformation of irradiated V, radiation anneal hardening of Nb and Mo, effects of tritium and He^{+3} on low temperature deformation of Nb, computer simulation of thermally activated dislocation motion, mechanical properties of V-Ti-O monocrystal alloys, dynamic microplasticity, and preparation of V monocrystals. (JRD)

32847 ATOMIC DISPLACEMENTS IN LOW-TEMPERATURE ELECTRON-IRRADIATED COBALT. Maury, F.; Lucasson, A.; Lucasson, P. (CNRS, Orsay, France). Radiat. Eff.; 21: No. 1, 65-70(1974).

Irradiations of polycrystalline specimens of cobalt at various electron energies and at low temperature were performed. It was found impossible to explain the obtained data by using a simple step function for the probability of displacement P(T) as a function of the kinetic energy T imparted to a struck atom. More involved functions have to be considered. For irradiation temperatures lower than 6°K, the onset threshold is found to be: $T_d = 22 \pm 1$ eV and the experimental results are best fitted by a theoretical cross-section curve calculated with: $P(T) = 0$ if $T < 22.5$ eV; $P(T) = 0.50$ if $22.5 \leq T < 31$ eV; and $P(T) = 0.78$ if 31 eV $\leq T$. The onset threshold and the shape of P(T) found depend on the irradiation temperature. The reasons for this are discussed. (auth)

32848 RADIATION DAMAGE IN ION IMPLANTED VANADIUM. Gettings, M.; Meyer, O.; Linker, G. (Kernforschungszentrum, Karlsruhe, Ger.). Radiat. Eff.; 21: No. 1, 51-59(1974).

Single crystal vanadium has been implanted with Ga, Bi, In, Cs, Se, and Kr ions in the energy range between 40 and 300 keV and doses in the range 10^{14} to 10^{17} ions/cm^2. Implanted samples were analyzed using the back-scattering and channeling technique. The depth of damage was found to be considerably greater than the projected range of the implanted ions, and dependent on ion energy and dose. Only a small dependence of the amount of damage on these parameters was detected. A low damage density was observed in the range of the implanted ions for doses up to 10^{16} ions/cm^2 whereas for higher doses and for Ga implants after heat treatment the formation of a polycrystalline layer in this region occurred. A break-up of this layer at temperatures of about 1000°C was accompanied by a loss of the implanted constituent. At low doses (<10^{16} ions/cm^2) and for all ions a broad annealing stage for the radiation damage was observed between 500 and 900°C. A strong dependence of the substitutional component on the atomic radii of the implanted ion was also detected. An enhanced substitutional solubility of Ga in vanadium was achieved with the implantation technique. (auth)

32849 EFFECT OF STRESS ON THE MICROSTRUCTURE OF NEUTRON IRRADIATED COLD WORKED TYPE 316 STAINLESS STEEL. Brager, H. R.; Gilbert, E. R.; Straalsund, J. L. (Westinghouse Hanford Co., Richland, WA). Radiat. Eff.; 21: No. 1, 37-50(1974).

20% cold worked type 316 stainless steel in the form of uniaxially stressed solid rod and pressurized tubes was irradiated at 450°C in the EBR-II. Five irradiated and three unirradiated specimens were examined by transmission electron microscopy to determine the effect of stress on microstructure and possible mechanisms related to creep occurring during fast reactor irradiation. The dislocation density markedly decreased during the interval of transient irradiation creep. The in-reactor creep of the steel occurred independent of swelling since cold work suppressed void formation in both the stressed and the unstressed irradiated material. For the conditions investigated, stress had only a minor effect on the final microstructure compared with that due to irradiation. Although uniaxial stress significantly affected the size of the irradiation induced Frank loops, irradiation creep does not apppear to be controlled by the strain from stress biased Frank loop formation. Within a 90% certainty level the mean Frank loop size increases with the increase in the stress component normal to the {111} plane of the loop. The corresponding maximum diameter of these sessile loops was also stress dependent. While the loop size increased with an increase in the stress component normal to the loop plane, the loops which formed on planes having the uniaxial stress nearly parallel to the {111} plames were smaller than loops produced in the unstressed irradiated sample. These results suggest that uniaxial stress influences the growth rate of Frank loops. A similar effect of stress on loop size was not observed in the sample biaxially stressed during irradiation. No significant effect of stress on loop nucleation could be determined. Effects of stress on loop number density might be masked by the large variations in the numbers of loops formed on the different {111} planes. (auth)

32850 BACKSCATTERING ANALYSIS OF ION BOMBARDMENT DAMAGE IN Nb AND W AT LOW (25°K) TEMPERATURE. Pronko, P. P.; Boettiger, J.; Davies, J. A.; Mitchell, J. B. (Atomic Energy of Canada Ltd., Chalk River). Radiat. Eff.; 21: No. 1, 25-30(1974).

Bombardment-induced damage in single crystals of tungsten and niobium, implanted with 300-keV Ar^+ at 25°K, has been examined by means of the channeling-effect technique. Target temperature was maintained at 25°K throughout the implantation and subsequent analysis in order to minimize annealing effects. Very high implantation doses (compared with doses involved in semiconductor work) had to be used before significant damage was observed. This would indicate that a strong spontaneous recovery occurs in these metals even at 25°K. The damage was seen mainly as an enhanced dechanneling component. In niobium a slight indication of a damage peak was also observed. Preliminary annealing studies did not show any significant annealing stages between 25 and 300°K in the case of tungsten, while some annealing between 25 and 300°K was observed in niobium. (auth)

32851 VOIDS IN NEUTRON IRRADIATED AND ANNEALED NIOBIUM AND NIOBIUM-1% ZIRCONIUM ALLOY. Michel, D. J.; Moteff, J. (Univ. of Cincinnati). Radiat. Eff.; 21: No. 4, 235-243 (1974).

Transmission electron microscope studies of Nb and Nb-1Zr alloy irradiated to a fast neutron fluence of 2.5×10^{22} n/cm^2 at 425, 585, and 790°C revealed the presence of voids in Nb at all three irradiation temperatures and unusually large voids in the Nb-1Zr irradiated at 790°C. No voids were observed in the Nb-1Zr irradiated at 425 and 585°C. The voids in Nb irradiated at 425 and 585°C were completely annealed after one hour at 1230°C (~0.55 T_m) whereas complete annealing of the voids in Nb irradiated at 790°C occurred after one hour at 1380°C (~0.60 T_m). The anneals at 1230 and 1380°C for the Nb-1Zr alloy irradiated at 790°C served to increase the void size and decrease the void concentration. All evidence of the high concentration of small dislocation loops present in the Nb-1Zr alloy irradiated at 425 and 585°C was absent after annealing at 1230°C. Microhardness measurements of both materials indicated that the significant radiation induced strengthening of Nb and Nb-1Zr at 425 and 585°C was almost completely recovered by annealing at 1230°C. Very little radiation-induced strengthening of both materials occurred at 790°C and was partially recovered during annealing at 1230°C. Annealing at 1380°C produced additional recovery for both materials at all irradiation temperatures. From an analysis of the results, it was concluded that vacancy trapping at oversize solute atoms was responsible for the suppression of void formation in the Nb-1Zr alloy during irradiation at 425 and 585°C. However, the formation of voids in the Nb-1Zr alloy during irradiation at 425 and 585°C. However, the formation of voids in the Nb-1Zr alloy during irradiation at 790°C was concluded to be the result of simultaneous oxygen and/or nitrogen or carbon and vacancy migration. A reduction of the free vacancy concentration in the Nb-1Zr alloy by vacancy trapping was found to enhance the void formation process at 790°C. (auth)

32852 STUDY OF ELECTRON IRRADIATION DAMAGE IN SINGLE CRYSTALS OF MOLYBDENUM. Biget, M.; Vajda, P.; Lucasson, A.; Lucasson, P. (CNRS, Orsay, France). Radiat. Eff.; 21: No. 4, 229-234(1974).

High-purity zone-refined molybdenum single crystals of the orientations (100), (110), (111), and (112) have been irradiated with electrons of 0.8 to 1.7 MeV energy at liquid helium temperatures. The lowest energy for atomic displacement was observed for the (100) specimen at $E_d = 850 \pm 20$ keV, which corresponds to a maximum transmitted energy of $T_d^{(100)} = 36 \pm 1$ eV. For the other crystals, the apparent thresholds varied between 860 and 890 keV. Near T_d, maximum damage rates were obtained for the (100) sample, followed by (110), (111) and (112); at $T \gtrsim 2.5\ T_d$, the damage rates were largest for (110), followed by (111), (100) and (112). Strong anisotropy effects were noted during annealing stage I as concerns the four substages after low and high energy irradiation for the various orientations. (auth)

32853 RECRYSTALLIZATION INDUCED BY ELECTRON IRRADIATION OF DEFORMED NICKEL. Das, G.; Mitchell, T. E. (Case Western Reserve Univ., Cleveland). Scr. Met.; 8: No. 10, 1135-1140(Oct 1974).

99.987% pure Ni rods were deformed in tension to 20% strain at room temperature. Foils were prepared and irradiated in a 650-kV HVEM at a damage rate of 2.3×10^{-3} dpa/s at 500°C. Microstructural changes after different irradiation times were observed. A recrystallized grain first appears at the cell boundary after 180 min irradiation; its growth is anisotropic, with its maximum growth rate in ⟨110⟩. It swept out all defects. (DLC)

32854 TRANSFORMATION OF SIMPLE DEFECTS IN RADIATION CONVERTED P-TYPE Ge AT 200°K. Krynicki, J.; Rzewuski, H.; Werner, Z. (Univ., Warsaw). Radiat. Eff.; 21: No. 3, 193-195(Mar 1974).

Defects created by electron irradiation of n-type germanium at 85°K were studied by electrical measurements in the temperature range of 80 to 300°K. The annealing processes observed were found to be strongly dependent upon the electron energy. These results provide new evidence for the tentative divacancy-interstitial model of defects created which explains their temperature transformation at 200°K. (auth)

32855 DIRECT RECOMBINATION OF INTERSTITIAL ATOMS AND VACANCIES IN AN IRRADIATION DAMAGE CASCADE. Foreman, A. J. E. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Radiat. Eff.; 21: No. 2, 81-90(1974).

Computer calculations have been made of the fraction of interstitial atoms and vacancies that directly recombine by diffusion in a damage cascade, neglecting the effect of defect clustering. The shape of the cascade is idealized to be either cylindrical or spherical, which should provide a useful guide to the more complicated shapes occurring in practice, and the point defects are given a gaussian distribution initially. A special feature of the calculations is that the initial spread of the interstitials is allowed to exceed that of the vacancies, due to the propagation of dynamic crowdions during the formation of the cascade. The present calculations have the merit that (i) a rapid estimate of the recombination can be made, (ii) a complete anneal is performed whereas often only partial anneals can be achieved with

more sophisticated atomic models, and (iii) allowance is made for the trapping of interstitial atoms at other sinks. The results are presented in a convenient nondimensional form as a function of the size and density of the cascade. They seem to be most relevant to higher temperatures, where less defect clustering occurs, and show a marked dependence on the initial spread of the interstitials relative to the vacancies. The diffusion of the vacancies has little effect on the recombination provided $D_v < D_i/100$, which is usually the case. The application of the results to several well-known computed cascades in α-Fe suggests that about 85% of the defects in these cascades are likely to recombine at high temperatures. Such a high level of recombination would markedly affect the estimated damage rate (dpa/unit time) produced by neutrons or heavy particles, which is relevant to the interpretation of quantitative void growth experiments. However there is a possibility that the defects may be too dense in these cascades and further work on more realistic cascades is required to decide if the damage rate need be modified. (auth)

32856 RESISTOMETRIC STUDY OF DEFECTS IN RHENIUM FOLLOWING 2.8 MeV ELECTRON IRRADIATION AT 4.5 K. Vandenborre, H.; Stales, L.; Cornelis, J.; Nihoul, J. (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). Radiat. Eff.; 21: No. 2, 137-139(1974).

The low temperature radiation damage in rhenium caused by 2.8 MeV electron irradiation at 4.5°K has been studied by means of electrical resistivity measurements. The most important irradiation data are tabulated, and a diagram shows the observed damage rate as a function of the irradiation-induced resistivity increment, which is a measure of the total instantaneous point defect concentration. The effect of annealing is shown. The results are discussed, with particular reference to the recombination of close Frenkel pairs, and conclusions are presented. (UK)

32857 NEAR THRESHOLD ELECTRON DAMAGE IN ALUMINIUM. Purity Effects. Wolfenden, A. (Oak Ridge National Lab., TN). Radiat. Eff.; 21: No. 3, 197-199(Mar 1974).

In recent experiments (Wolfenden, Radiation Effects; 14: 225 (1972)) foils of zone-refined aluminum, both with and without preinjected helium, were bombarded with electrons in an electron microscope operating at voltages in the range 150 to 200 kV. Electron damage was produced in the helium-doped aluminum after about 90 min irradiation time at 150 kV. No damage was seen at 150 kV in the uninjected aluminum for irradiation times over 4 h. Since the concensus of opinion for aluminum is that the threshold energy for atomic displacement, T_d, is near 16 eV (~170 keV incident electron beam energy), the observation of electron damage at 150 kV ($T_d \sim 14$ eV) constituted evidence for "sub-threshold" events. The microscope experiments have been extended to cover electron irradiation of less pure aluminum at voltages in the range 150 to 200 kV. Evidence is presented for sub-threshold damage at 150 kV in 99.996 wt% pure aluminum preinjected with a few ppM helium. The results are compared with those for high-purity aluminum. (UK)

32858 POSITRON ANNIHILATION IN NEUTRON-IRRADIATED NICKEL SINGLE CRYSTALS. Hasegawa, M.; Suzuki, T. (Tohoku Univ., Sendai). Radiat. Eff.; 21: No. 3, 201-202(Mar 1974).

An investigation was made into positron annihilation in neutron-irradiated nickel single crystals. A nickel in-situ activation method was used taking advantage of a nuclear reaction $^{58}Ni(n,p)^{58}Co$. It was found that the angular correlation of positron annihilation is very sensitive to voids and displacement damages induced by neutron irradiation in fcc metal crystals. Hence the positron annihilation method using in-situ activated nickel source is very useful for a nondestructive testing for swelling of stainless steel and nickel alloys which are usually used as reactor materials. (UK)

32859 INTERSTITIAL CONCENTRATION DEPENDENCE OF HARDENING IN NEUTRON IRRADIATED VANADIUM. Hasson, D. F.; Arsenault, R. J. (United States Naval Academy, Annapolis, MD). Radiat. Eff.; 21: No. 3, 203-204(Mar 1974).

A study of irradiated vanadium with various interstitial concentrations and interstitials was performed. Both polycrystalline and single crystal compression samples were used. Interstitial doping with oxygen, carbon, or nitrogen was carried out. The samples were irradiated to 1.6×10^{19} n/cm^2 (E > 1 MeV) at a temperature of 70°C. Both unirradiated and irradiated samples were tested in compression at 300°K and at a strain rate of 8.3×10^{-5} s^{-1}. The results are presented and discussed. It is concluded that the increase in the room temperature yield stress of neutron irradiated vanadium is more dependent on the interstitial concentration than on the radiation damage. (UK)

32860 NEUTRON IRRADIATION, STRESS GRADIENTS KIRKENDALL SHIFTS. Hesketh, R. V. (Central Electricity Generating Board, Berkeley, Eng.). Radiat. Eff.; 21: No. 3, 205-207(Mar 1974).

Reference is made to a previous publication (Mosedale, Rad. Effects; 19: 205 (1973)) in which it is suggested that a stress gradient causes creep in a specimen undergoing neutron irradiation. A mathematical model of the diffusion of interstitials and vacancies through a crystal lattice is developed introducing the Kirkendall shift. It is concluded that there is no first- or second-order irradiation creep. (UK)

32861 IONIC EMISSION YIELD FOR ALLOYS DEPENDENCE ON THE NATURE OF THE SOLUTE. I. Experimental Results. Blaise, G.; Slodzian, G. (Paris Univ., Orsay, France). J. Phys. (Paris); 35: No. 3, 237-241(Mar 1974). (In French).

Solid solutions of transition elements in copper, nickel, cobalt, iron, and aluminum matrices are analyzed by secondary ion emission. A reinforcement phenomenon of the ion production of solute elements is observed. This effect is particularly noticeable for titanium in a copper matrix or chromium in a nickel matrix. (FR)

32862 ELECTRON EFFECTS IN THE PLASTIC DEFORMATION OF METALS (REVIEW). Troitskii, O. A.; Spitsyn, V. I. (Inst. of Physical Chemistry, Moscow). Metallofizika; No. 51, 18-45(1974). (In Russian).

The effect of the decrease of the resistance of metals to plastic deformation during irradiation with accelerated electrons and the transmission of the current through the deformed samples was studied. The regime studied of the electron effect excludes the possibility of heating of the samples. It was shown that at the moment of the transmission of the accelerated electrons a decrease of the deforming force occurs in tests with elongation of the samples at a constant rate. The rate of relaxation of the stress and the depth of the relaxation during stopping of the elongation was increased. The creep rate of the metals in tests with deformation of the samples under constantly applied stress was also increased. The temperature, rate, and energy dependence of the effect and its dependence on the intensity of the radiation and on the concentration of impurities in the metals were studied. It was shown that during electron bombardment the probability of brittle fracture of the metals was decreased. It was established that during electron bombardment the activation volume is essentially unchanged, and the decrease of the resistance of the metals to plastic deformation is explained by the decrease of the time (by increase of the frequency) for overcoming the barriers connected with the damping of the moving and slowing down dislocations by the electrons. Studies were made on Zn, Pb, In, and Zn alloyed with very small additions of Cd. (71 references) (tr-auth)

32863 DISPERSION OF MATERIALS UNDER THE ACTION OF FISSION FRAGMENTS. Bessonov, V. A. At. Energ. (USSR); 37: No. 1, 52-56(Jul 1974). (In Russian).

The problem of surface destruction of thin foil and layers containing fissionable materials under the action of fission fragments is considered. It is shown that the dispersion factor depends on the state of the sample surface, the presence of oxide on the surface, and the thickness of the source for thicknesses commensurable with the size of the crater left by a fission fragment at its point of exit. The effect of the crystalline structure of a source surface and the phenomenon of re-ejection during the process of dispersion and accumulation of atoms on a collector are analyzed. A number of examples are used to show that dispersed atoms on the collector may group into aggregates of atoms. Under an electron microscope and in analyzing collectors by the method of track detectors, one may observe individual uranium nuclei and aggregates of nuclei, spots of up to several hundred angstroms. It has been shown that certain materials, e.g., carbon dispersed on the surface of fissionable material in the form of a thin layer of several hundred angstroms, may lead to complete cessation of material surface dispersion under the action of fission fragments. (44 references) (auth)

32864 EFFECTS OF IRRADIATION-INDUCED DEFECTS ON THE MECHANICAL PROPERTIES OF TUNGSTEN. Reft, C. S. Pittsburgh; Univ. of Pittsburgh (1973). 152p. University Microfilms Order No. 74-19,526.

Thesis (Ph.D.).

Single-crystal annealed and cold-worked tungsten samples were irradiated near 4.2°K by 10.1-MeV protons or 13.7-MeV deuterons. The dependence of the internal friction and the dynamic Young's modulus upon irradiation dose and temperature was studied. The irradiation of these samples produced initial dislocation pinning and a subsequent "bulk effect" when integrated fluxes exceeded

1×10^{16} particles/cm^2. The magnitude and rate of pinning were dependent upon the pre-irradiation annealing and cold working. The maximum pinning occurred for samples compressed near 3% while the annealed samples exhibited pinning rates about an order of magnitude greater than the cold worked samples. The pinning of samples compressed 4% or greater obeyed a loop immobilization process whereby whole dislocation loops were pinned by the irradiation-induced defects. The average bulk effect was $d\ln Y/d\varphi = -.05\%/10^{16}$ particles/cm^2 for both the annealed and cold worked samples, where Y is Young's modulus. Annealing studies performed after an initial dose of about 1×10^{14} particles/cm^2 showed that defect migration occurred near 30°K. After completion of the irradiation, additional annealing experiments revealed an irradiation-induced internal friction peak at approximately 10°K. This peak which resulted from defect reorientation without migration was independent of preirradiation annealing or moderate cold working (up to 5% compression). (Diss. Abstr. Int., B)

32865 HIGH-TEMPERATURE RADIATION GROWTH OF ANISOTROPIC CRYSTALS. Saralidze, Z. K. At. Energ. (USSR); 37: No. 2, 149-153(Aug 1974). (In Russian).

It can be expected that in anisotropic crystals, as a result of the dependence of the interaction energy of point defects with dislocations on the orientations of the latter relative to the crystallographic axes, the total diffusion flux of point defects to a unit dislocation length will also depend on the dislocation orientations. On the basis of this dependence, a theory of diffusion-dislocation growth of anisotropic crystals in the process of high-temperature irradiation was developed. An expression for the growth rate along the direction evolved by the anisotropy is obtained and the dependence of the rate on the irradiation temperature and intensity of point defect formation is analyzed. (auth)

32866 COMPARISON OF STAGE 1 OF THE RECOVERY OF THERMAL AND FAST NEUTRON DAMAGE IN COPPER, SILVER, AND PLATINUM. Isebeck, K.; Poole, K. F. (Atomic Energy Board, Pelindaba, Pretoria). Radiat. Eff.; 22: No. 1, 15-27(May 1974).

Specimens of Cu, Ag, and Pt were irradiated in a fast neutron flux to a dose of about 2.5×10^{15} n/cm^2, yielding defect densities of about 4×10^{-4}, and stored at 4.4°K. Specimens with the same prehistory were irradiated in a thermal neutron flux until the resistivity changes were the same as those recorded for the fast neutron irradiation. All samples were simultaneously annealed according to an isochronal program. The annealing peak temperature of stage I_E of Cu could be related to the well known electron damage data. For silver, a stage similar to I_E was found in the (n,γ)-damaged sample. In platinum prominent stages I_E were found both in the (n,γ)-damaged and neutron-damaged samples. Stage I_E is somewhat smaller in the irradiated samples, compared with the (n,γ)-damaged samples. (auth)

32867 ELECTRO IRRADIATION DAMAGE IN TITANIUM. Wolfenden, A.; Yoo, M. H. (Oak Ridge National Lab., TN). Radiat. Eff.; 22: No. 1, 67-70(May 1974).

Point defects created by electron irradiation can cluster into prismatic dislocation loops and voids during in situ bombardment in a high voltage electron microscope (HVEM). An account is presented of the development of unfaulted prismatic dislocation loops in Ti during electron bombardment at 450°C in the HVEM operating at 635 kV. These loops seem to obey growth kinetics that are limited by the condition that the foil surfaces are dominant sinks for interstitials. (UK)

32868 NEUTRON RADIATION DAMAGE IN ZIRCONIUM AND ITS ALLOYS. Northwood, D. O.; Gilbert, R. W. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Radiat. Eff.; 22: No. 2, 139-140(Jun 1974).

Publications relating to the nature of radiation induced defects in zirconium and its alloys are discussed; in particular the absence of voids at high fluences and temperatures 0.3 to 0.5 T_m. It is stated that neutron irradiation does produce a dislocation structure to which interstitials could migrate and plate out, leaving an excess of vacancies to form voids. That voids are not formed would seem to depend (it is suggested) more on the small volume of insoluble gas. A recent publication is referred to, describing the formation of voids in zirconium by electron irradiation of material previously implanted with helium ions. (UK)

32869 PRODUCTION OF FRENKEL DEFECTS IN fcc METALS. Chaplin, R. L. (Clemson Univ., SC). Radiat. Eff.; 22: No. 2, 117-121(Jun 1974).

Experimental results from polycrystalline and single crystalline samples of aluminum are analyzed in terms of how electron irradiation causes atomic displacements along ⟨100⟩ and ⟨110⟩ crystallographic directions. This interpretation is made for atoms that recoil with energies slightly greater than the threshold energy. It is noted that definite correlations exist between some of the sub-stages of stage I and the natural required behavior of recoiling atoms. By applying this criterion to polycrystalline samples, a means is established for identifying other phenomena; e.g. multiple atomic displacements, spontaneous recombination, etc. (auth)

32870 TIME DEPENDENCE OF RADIATION DAMAGE CASCADES. Sanders, J. B.; Winterbon, K. B. (Stichting Voor Fundamental Onderzook der Materie, Amsterdam). Radiat. Eff.; 22: No. 2, 109-115(Jun 1974).

Equations describing the time-dependent evolution of heavy-ion radiation damage cascades are derived, and some numerical calculations are presented. The derivation is more rigorous than the usual time-independent one. (auth)

32871 DEFECT PRODUCTION IN VANADIUM BY LOW ENERGY ELECTRON IRRADIATIONS. Miller, M. G.; Chaplin, R. L. (Clemson Univ., SC). Radiat. Eff.; 22: No. 2, 107-108(Jun 1974).

The threshold energy for atomic displacement in vanadium was measured to be 26 ± 2 eV. In addition, a preliminary annealing spectrum of the damage induced by 0.5 MeV electrons is presented. (auth)

Other Materials

Refer also to abstracts 32227, 32279, 33046, 34047, 34187, and 34201.

32872 (AD-777982) DEFECT CREATION IN SEMICONDUCTORS. Corbett, J. W.; Bourgoin, J. C. (State Univ. of New York, Albany (USA). Dept. of Physics). 1973. Contract N00014-70-; 0296. 355p. NTIS $8.00.

The bulk of the material deals with defects introduced by the interaction of energetic particles with the lattice, and the major portion of that deals with what is called displacement damage. Energetic particles interact with the lattice in two ways: (1) ionization of the lattice (and in most cases this is the dominant process); and, (2) direct collisions with the nucleus which result in a recoil energy being imparted to that nucleus (atom). (GRA)

32873 (AED-CONF-74-072-003) STRUCTURAL CHANGES IN PARACRYSTALLITES OF DRAWN POLYETHYLENE BY IRRADIATION. Loboda-Cackovic, J.; Cackovic, H.; Hosemann, R. 1974. 9p. (CONF-740342-2). INIS.

From meeting of lecturers in chemistry; Stuttgart, F. R. Germany (31 Mar 1974).

6 figs.; 2 tabs.; 9 refs. With abstract. Available from ZAED.

Ten-fold hot-stretched (80°C) linear polyethylene was prepared for a high-precision AEG-Guinier-Jagodzinski camera by cutting into 0.1 mm thick slices. The line profiles of all hk0-reflections were clearly separated and analyzed using the paracrystalline theory. The slices were first annealed at 120°C and then irradiated under vacuum with 10, 100, and 300 Mrad of ^{60}Co. The paracrystalline g-values increase mostly orthogonal to the (110) net planes and no microstrains are generated. The average size of the microparacrystallites increases at least until 100 Mrad. (GE)

32874 (AED-CONF-74-160-001) EXPERIENCE WITH ELECTRON BEAM HARDENING IN SURFACE COATING. Diepstraten, H.M.P. (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Reaktorbetrieb und Technik). 1974. 8p. (In German). INIS.

From experts meeting: surface treatment; Hannover, F. R. Germany (29 Apr 1974).

The advantages and disadvantages of the electron beam hardening of varnishes, in particular for the surface treatment of wood, are presented and the present state of technology concerning the method and apparatus are explained. It is concluded that the electron beam hardening after a period of intensive and costly research is at a sufficiently advanced stage to be used in industry. The numerous advantages, particularly as regards the energy consumption and the environmental protection, opens a wide field of application for the future, not only for wood and plastic coating but also for metallic tape hardening. (GE)

32875 (ANL-CT-74-45824-0008) ^{60}Co GAMMA IRRADIATION OF POLYARYLENE (STILAN™) AT TEMPERATURES UP TO 500°F. Popper, G. F.; Stair, K. E. (Argonne National Lab., Ill. (USA)). 17 Jun 1974. Contract W-31-109-eng-38. 10p. AT.

Changes in the mechanical properties of Stilan (an organic plastic) upon γ irradiation at 250 to 500°F were observed. Tensile strength and elongation were measured; γ dose varied from 1 to 4.2×10^9 rads. Results indicate that Stilan should be useable as

a dielectric for coaxial cables in radiation fields at room temperature and 500°F; an anomaly occurs at 300°F. (DLC)

32876 (CONF-730618-, pp 57-74) CHEMICAL STUDIES OF ION IMPLANTATION. Maddock, A. G. (Chemical Labs., Cambridge, Eng.). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A brief account is given of the correlation between the behavior of ion implanted and nuclear recoil generated atoms in complex solids. The behavior of sulfur and phosphorus in the alkali chlorides is considered in more detail. (auth)

32877 (IFA-NR-54-1974) SINGLE CRYSTAL SILICON TARGETS FOR BLOCKING AND CHANNELING EXPERIMENTS. Lazarovici, D. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

The preparation of thin targets by mechanical and chemical processing of single-crystal silicon is described. Targets of 16-23 microns with about one micron uniformity were obtained using a "step etching" method. A practical method of thickness check, using low-energy beta transmission (^{35}S), was perfected. (auth)

32878 (JPL-TM-33-467) PROCEEDINGS OF THE THIRD ANNUAL CONFERENCE ON EFFECTS OF LITHIUM DOPING ON SILICON SOLAR CELLS, PASADENA, CALIFORNIA, APRIL 27-28, 1970. Berman, P. A.; Weingart, J. (eds.). (Jet Propulsion Lab., Pasadena, Calif. (USA)). 1 Apr 1971. Contract NAS 7-100. 134p. (CONF-700459-).

The purpose was to provide a forum for discussing investigations being carried out under NASA/JPL sponsorship as part of the Solar Cell R and D program. Besides a summary of the proceedings, 15 papers are included. Separate abstracts were prepared for 12 papers. (DLC)

For abstracts of individual papers see: 32879-32890.

32879 (JPL-TM-33-467, pp 19-40) USE OF LITHIUM TO RADIATION-HARDEN SOLAR CELLS. Carter, J. R. Jr.; Downing, R. G. (TRW Systems, Redondo Beach, CA). Apr 1971.

From 3rd annual conference on effects of lithium doping on silicon solar cells; Pasadena, California, USA (27 Apr 1970).

From Hall and capacitance measurements, the silicon A center (oxygen-vacancy pair) is the major defect formed during irradiation of a Li-diffused quartz-crucible solar cell. In the case of the irradiation of Li-diffused FZ solar cells, the silicon A center is also formed; however, a second defect with a deeper-lying energy level (probably a lithium-vacancy pair) is also formed. Both defects are annihilated by reactions with lithium donors during recovery. When Li-diffused solar cells are fabricated with an optimum diffusion schedule, they are superior in radiation resistance to contemporary N/P cells after electron irradiations of 3×10^{15} e/cm^2. Such irradiated and recovered lithium cells will produce 10 to 20% more power than a similarly irradiated contemporary N/P solar cell. Initial efforts at lithium counter-doping of P-type silicon suggests the feasibility of lithium hardening of N/P solar cells. (3 tables, 31 figures) (auth)

32880 (JPL-TM-33-467, pp 59-65) HALL EFFECT STUDIES OF IRRADIATED Si(Li) AT CRYOGENIC TEMPERATURES. Stannard, J. (Naval Research Lab., Washington, DC). 1 Apr 1971.

From 3rd annual conference on effects of lithium doping on silicon solar cells; Pasadena, California, USA (27 Apr 1970).

There is no established connection between radiation-induced degradation in solar cells and the measured concentrations of defect centers. However, the results obtained agree qualitatively with solar cell experience in both the damage and recovery phases. In the damage process, the Li-doped sample showed greater damage than its phosphorus-doped control. While there was an apparent reduction in E center formation due to lithium, there was also a much larger production of deep acceptors. During room-temperature annealing, definite evidence of the effectiveness of lithium in removing electrically active centers was obtained. When lithium was allowed to become mobile, a damage-induced center at E_c 0.12 eV was observed first to move deeper into the gap and then decrease in concentration as annealing proceeded. Significant decreases in the deep acceptor concentration have occurred only after 70 h. (7 figures) (auth)

32881 (JPL-TM-33-467, pp 67-72) INTRODUCTION AND ANNEALING OF DAMAGE IN LITHIUM-DIFFUSED SILICON. Naber, J. A.; Passenheim, B. C.; Horiye, H. (Gulf General Atomic Inc., San Diego, CA). 1 Apr 1971.

From 3rd annual conference on effects of lithium doping on silicon solar cells; Pasadena, California, USA (27 Apr 1970).

The introduction and annealing of recombination centers in 30-MeV electron-irradiated, Li-diffused silicon depend on the presence of lithium. The greater the lithium concentration, the greater the introduction rate of recombination centers and their annealing properties. These results are consistent with the damage and annealing model in which the major recombination center contains lithium (vacancy-lithium or vacancy-lithium-oxygen complex) or is affected in its production by lithium. The annealing of the recombination center is due to the diffusion of free lithium to it. The neutron-irradiation data for Li-diffused silicon is consistent with the recombination center being clustered in nature, and annealing of the clusters depends on the diffusion of lithium to it. The decreased introduction rate of Si-G7, Si-G8, and Si-B1 centers in electron-irradiated Li-diffused silicon is attributed to the presence of lithium. The reasons for these decreased introduction rates are either the large lithium capture cross section for the vacancy or the lithium-impurity pairing. The studies of the Si-G7, Si-G8, and Si-B1 centers help support the model that all damage centers in electron-irradiated, Li-diffused silicon contain lithium or are affected in their production by lithium. Furthermore, the annealing of all damage centers in both electron- and neutron-irradiated Li-diffused silicon is due to the diffusion of lithium to these centers. (5 figures) (auth)

32882 (JPL-TM-33-467, pp 73-80) RADIATION EFFECTS IN BULK LITHIUM- AND ALUMINUM-DOPED SILICON. Curtis, O. L. Jr.; Bass, R. F. (Northrop Corporate Labs., Hawthorne, CA). 1 Apr 1971.

From 3rd annual conference on effects of lithium doping on silicon solar cells; Pasadena, California, USA (27 Apr 1970).

Effects of γ irradiation doses of 1.1×10^{8} γ/cm^2 (6.8×10^{6} R) were studied using carrier lifetime measurements, annealing, and heat treatments. (DLC)

32883 (JPL-TM-33-467, pp 81-84) REAL-TIME IRRADIATION OF LITHIUM-DOPED SOLAR CELLS. Statler, R. L. (Naval Research Lab., Washington, DC). 1 Apr 1971.

From 3rd annual conference on effects of lithium doping on silicon solar cells; Pasadena, California, USA (27 Apr 1970).

Low-flux ^{60}Co irradiation of illuminated solar cells at various temperatures proved to be useful for comparing both Li-doped and conventional solar cells. The real-time dose rates and solar simulator measurements provide a more realistic evaluation for the performance of solar cells in environments which more nearly approximate the conditions of their utilization. No advantage was observed for the four types of Li-doped solar cells over the standard N/P solar cell for the temperature region of 30 to 60°C, with a bombarding electron fluence up to 1×10^{14} el/cm^2. On the other hand, this experiment disclosed a temperature-dependence of radiation damage and the suggestion of some type of thermally induced damage in N/P cells and high Li concentration FZ cells. (auth)

32884 (JPL-TM-33-467, pp 85-92) OBSERVATION OF STRUCTURAL DAMAGE IN LITHIUM-DOPED SILICON SOLAR CELLS PRODUCED BY NEUTRON IRRADIATION. Sargent, G. A.; Ghosh, S. (Univ. of Kentucky, Lexington). 1 Apr 1971.

From 3rd annual conference on effects of lithium doping on silicon solar cells; Pasadena, California, USA (27 Apr 1970).

Undoped and Li-doped silicon solar cells of doping level 10^{15}, 10^{16}, 10^{17} lithium atoms/cm^3 were irradiated with neutrons produced by a Cockroft-Walton generator to doses of 10^{10}, 10^{11}, 10^{12}, and 10^{13} neutrons/cm^2. The cells were thinned by chemical polishing, etched, and observed by surface replication and thin film transmission electron microscopy. In the unirradiated and Li-doped samples, there was some evidence that lithium was present in the form of finely dispersed precipitates. Damage to the cells produced by irradiation could be observed as etch pits in the form of shallow craters at the surface and as circular regions within the bulk of the sample by surface replication and transmission electron-microscopy. The apparent size and distribution of the observed defects were in accord with the theories of defect clusters proposed by Gossick and Crawford and Cleland. The density of defects produced by irradiation increased with increasing irradiation dose; however, the size of the defects seemed to decrease with the presence of lithium (9 figures) (auth)

32885 (JPL-TM-33-467, pp 93-100) OPTICAL PROPERTIES OF SILICON AND THE EFFECT OF IRRADIATION ON THEM. Vedam, K. (Pennsylvania State Univ., University Park). 1 Apr 1971.

From 3rd annual conference on effects of lithium doping on silicon solar cells; Pasadena, California, USA (27 Apr 1970).

A new ellipsometric method for determining both the real and imaginary parts of the complex refractive index ($n_2 - ik_2$) of silicon is described. Measurements on cleaved samples of silicon reveal

that the true values of silicon for λ5461 Å are $n_2 = 4.140 \pm 0.02$ and $k_2 = 0.034 \pm 0.01$. Similar measurements on chemically polished samples yielded the values as $n_2 = 4.05$ and $k_2 = 0.028$, in agreement with literature and by electron microprobe studies. Optical absorption coefficient of intrinsic silicon was determined at a number of discrete wavelengths in the spectral range 400–1000 nm at room temperature. These measurements were also extended to liquid nitrogen and liquid helium temperatures. Results together with earlier measurements of the refractive index of silicon, provide reliable data on the optical constants of intrinsic silicon, and thus form the basis for comparison with similar properties of doped and Li-diffused silicon. Irradiation of silicon with 6-MeV protons to fluences of 10^{15} particles/cm^2 does not produce any noticeable change in its optical properties determined by reflectivity. (4 figures) (auth)

32886 (JPL-TM-33-467, pp 101-106) EFFECTS OF SUB-THRESHOLD HIGH-ENERGY ELECTRONS ON THE PROPERTIES OF SILICON PHOTOVOLTAIC CELLS. Crisman, E. E.; Loferski, J. J. (Brown Univ., Providence). 1 Apr 1971.

From 3rd annual conference on effects of lithium doping on silicon solar cells; Pasadena, California, USA (27 Apr 1970).

The possible effects on the electronic properties of Li-doped Si photovoltaic cells of irradiation by electrons whose energy is below that required to displace Si atoms are considered. Such electron irradiation can produce changes in surface recombination velocity s. They can also displace Li atoms because the atomic weights of Li atoms are 6 and 7, while those of Si are 28 and 29. Experimental procedures for observing the surface and bulk effects are described. Results of the experiments designed to determine whether bulk effects are associated with Li atom displacements are presented. It is concluded that Li atom displacement effects have been observed and that the displacement leads to a reduction in bulk lifetime. It is suggested that the electron irradiation is dislodging Li from complexes in which Li had neutralized a defect existing in Si as a natural result of events involved in the fabrication of Li-doped Si solar cells. (auth)

32887 (JPL-TM-33-467, pp 107-112) STUDY OF RADIATION EFFECTS IN LITHIUM-DOPED SI USING INFRARED SPECTROSCOPY (1 TO 50 μ) AND PHOTOCONDUCTIVITY (1 TO 10 μ). Mortka, T.; Corelli, J. C. (Rensselaer Polytechnic Inst., Troy, NY). 1 Apr 1971.

From 3rd annual conference on effects of lithium doping on silicon solar cells; Pasadena, California, USA (27 Apr 1970).

Radiation defects were introduced by electrons of energy 1.5, 5, and 45 MeV, at ≲320°K. IR spectroscopy and photoconductivity (PC) measurements were used to study the stable defects. The diffused lithium had concentrations of 10^{15} cm^{-3} to 10^{17} cm^{-3}. PC measurements reveal a localized energy level at E_c 0.62 eV which acts as an electron trap and is produced by radiation in all samples irrespective of oxygen content. Other levels which give rise to extrinsic PC due to defects are produced with predominant concentration and importance attributed to those levels greater than ≈0.20 eV below the conduction band edge. The PC spectrum does not exhibit the presence of energy levels at $E_c - 0.54$ eV and $E_c - 0.39$ eV, which were previously identified with the di-vacancy defect in Si. Also, strong effects of Li impurity atoms were observed on the 1.8-μ di-vacancy-associated defect absorption band in which less of the 1.8-μ band is produced as the Li concentration is increased. One conclusion is that both the PC and IR measurements show that the Li atoms act as efficient sinks for vacancies and di-vacancies by becoming attached to these defects and producing new complexes. An absorption band at 9.9 μ, found only in oxygen-rich Li-doped Si, was also found in both irradiated and unirradiated material and changed with heat treatment after a 48-MeV electron irradiation to a fluence of 10^{18} e/cm^2. (DLC)

32888 (JPL-TM-33-467, pp 113-114) KINETICS IN SOLAR CELL DAMAGE. Sosin, A. (Univ. of Utah, Salt Lake City). 1 Apr 1971.

From 3rd annual conference on effects of lithium doping on silicon solar cells; Pasadena, California, USA (27 Apr 1970).

An attempt was made to find a reaction rate model which would account for the results of P. H. Fang. The attempt was not successful; further studies are needed. (DLC)

32889 (JPL-TM-33-467, pp 115-124) DESCRIPTION OF LOW-RATE SPECTRAL ELECTRON IRRADIATION PROGRAM. Reynard, D. L. (Philco-Ford Corp., Palo Alto, CA). 1 Apr 1971.

From 3rd annual conference on effects of lithium doping on silicon solar cells; Pasadena, California, USA (27 Apr 1970).

The program is to update knowledge of lithium cell degradation characteristics. ^{90}Sr will be used to simulate the trapped electron environment. Equipment and experiment matrix are described. (DLC)

32890 (JPL-TM-33-467, pp 125-128) REAL-TIME STUDY OF THE EFFECT OF ELECTRON RADIATION ON LITHIUM P/N SOLAR CELLS. Dayton, R. R. (Lockheed-Georgia Co., Marietta). 1 Apr 1971.

From 3rd annual conference on effects of lithium doping on silicon solar cells; Pasadena, California, USA (27 Apr 1970).

A total of 144 solar cells divided among four temperatures (–50, 30, 60, and 80°C) are to be exposed to the ^{90}Sr beta spectrum in vacuum. The flux will be approximately 10^{12} electrons/cm^2/day. The duration of the test will be 100 days. This paper is primarily devoted to a description of the test facilities. The environmental chamber is made of stainless steel and may be divided into three sections. The main body of the chamber contains the test solar cells and a large fused silica window through which the light will be projected. Tc the right of the main body is the source handling and storage area and on the left is the vacuum pumping station. Data is collected in-situ by an automatic data collection system. The potential drop across a series of calibrated resistors as measured by a digital voltmeter is used to derive the I-V characteristic. The maximum power and maximum power point are computer-calculated. The beta source to solar cell geometry required to deliver the desired flux was determined by comparative analysis. The beta spectrum is shown. (auth)

32891 (JUL-1052-RW) PYROCARBON, AN IMPORTANT MATERIAL FOR HIGH TEMPERATURE GAS COOLED REACTORS. Gyarmati, E.; Koizlik, K.; Krautwasser, P.; Luhleich, H.; Nickel, H.; Schulze, H. A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellan). Mar 1974. 26p. INIS.

14 figs.; 27 refs. With abstract in German and English.

The present state of pyrocarbon technique is summarized, as far as its application to reactor technology is concerned. The deposition methods are described as well as the methods for characterization of the pyrocarbon deposits. Latest results of structural analysis of this material are presented. Theoretical model conceptions of pyrolysis and deposition mechanism and of microphysical processes during neutron irradiation and heat treatment of pyrocarbon coated fuel particles are described, and the experiments these models are based upon. (auth)

32892 (KFTI-73-26, pp 56-57) ANOMALOUS ELECTRON AND POSITRON SCATTERING BY SILICON MONOCRYSTAL AT 1 GeV ENERGY. Grishaev, I. A.; Morokhovskii, V. L.; Shramenko, B. I. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

The passage of 1-GeV electrons and positrons through Si monocrystals Cd = 185 and 640 μm was studied. A two-dimensional distribution of the beam current density and the dependence of the first dispersed beam on the angle between the beam and the [110] axis was determined. The orientation dependences of the current of first dispersed electrons and positrons had the same structure as was observed earlier for bremsstrahlung energy flux. (INIS)

32893 (KFTI-73-26, pp 93-95) ABSORBED DOSE DISTRIBUTION ON THE NaCl CRYSTAL DEPTH AT THE 10 MeV ELECTRON IRRADIATION. Gritsyna, V. T.; Lebedev, V. N.; Ryabka, P. M. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High physics and nuclear physics.

The distribution of an absorbed dose along the depth of NaCl crystals was studied. The concentration of color centers and the light sum of the thermoluminescence were used as relative measurements of the absorption. Curves were obtained for depth distribution of the absorbed dose by 15- by 25- and 25- by 25-mm crystals; luminescence light sum; and thermoluminescence for crystals irradiated at different depths of the stack. (INIS)

32894 ENERGY DISTRIBUTION OF SPUTTERED DIMERS. Konnen, G. P.; Tip, A.; de Vries, A. E. (Stichting voor Fundamental Onderzoek der Materie, Amsterdam). Radiat. Eff.; 21: No. 4, 269-274(1974).

A theoretical expression is obtained for the energy distribution of sputtered dimers from crystal surfaces. The derivation is based on a model in which the atoms that constitute a dimer are sputtered independently from the crystal according to their respective single particle energy distribution functions. Two neighboring atoms are then supposed to form a dimer if the sum of their initial relative kinetic energy and potential energy is less than zero. A comparison with experimental results for K_2 and KI sputtered from polycrystalline K and KI surfaces respectively, shows a good agreement. (auth)

32895 DOPING AND RADIATION DAMAGE PROFILES OF P^+ IONS IMPLANTED IN SILICON ALONG THE 110 AXIS. Cembali, F.; Galloni, R.; Mousty, F.; Rosa, R.; Zignani, F. (Consiglio Nazionale delle Richerche, Bologna). Radiat. Eff.; 21: No. 4, 255-264(1974).

Several doses of 200 keV phosphorus ions have been implanted under channeling conditions along the [110] direction in silicon. Range distribution has been determined for the three implant doses 10^{13}, 10^{14}, and 10^{15} P^+/cm^2 both with the electrical measurements and the neutron activation techniques. The radiation damage distribution has been determined both with 290 keV proton back-scattering analysis and with transmission electron microscopy (TEM) observations. Good agreement has been found between electrical and neutron activation profiles in the samples where 100% of the implanted dose had been electrically activated by means of annealing. Carrier concentration profiles, from samples implanted with 10^{15} P^+/cm^2, determined after two different annealing temperatures (500 and 700°C) have been compared with the radiation damage distribution and a correlation between damage and phosphorus electrical activation process seems to be possible. Maximum damage peak, as determined by back-scattering analysis, shifts from ~0.4 μm depth in the lower dose (5×10^{14} P^+/cm^2), to ~0.22 μm depth in the higher implanted dose (4×10^{15} P^+/cm^2). Damage distribution of phosphorus ions random implanted in the same experimental conditions shows a peak at ~0.2 μm depth. In accordance with the backscattering analysis, TEM observations on 10^{15} P^+/cm^2 implanted samples show the presence of amorphous regions at depth between 0.25 and 0.5 μm from the surface. In the most damaged layer ~0.3 μm in depth, a surface density of ~10^{12}/cm^2 amorphous regions 25 to 50 Å diameter was observed. (auth)

32896 DEPTH DISTRIBUTION OF PHORPHORUS IONS IMPLANTED INTO SILICON CRYSTALS. Blood, P. (Mullard Research Labs., Reigate, Eng.); Dearnaley, G.; Wilkins, M. A. Radiat. Eff.; 21: No. 4, 245-251(1974).

Ion implantation of phosphorus into misaligned silicon crystals leads to a deep penetrating tail in the range distribution, due possibly to scattering into channels or to an anomalous diffusion process. Experiments have been carried out to test the various diffusion mechanisms so far proposed. It is shown that none of them accounts satisfactorily for the tail, which develops during the implantation process and is not thermally activated. A channeling mechanism is therefore favored as the cause of the tail. (auth)

32897 LOW-TEMPERATURE PHOTOLUMINESCENCE FROM BORON ION IMPLANTED Si. Noonan, J. R.; Kirkpatrick, C. G.; Streetman, B. G. (Univ. of Illinois, Urbana). Radiat. Eff.; 21: No. 4, 225-228(1974).

Low-temperature photoluminescence has been used to investigate the lattice damage created by boron ion implantation in Si. Silicon wafers were implanted with 120 keV B^+ ions to fluences of 10^{13} and 10^{14} ions/cm^2 at room temperature. Annealing effects and the flux dependence of the luminescence spectra are reported. In agreement with previous results for electron irradiation, luminescence peaks attributed to the divacancy and the Si-G15 (K) center are observed. In addition, zero-phonon peaks which are not found in electron-irradiated Si are reported. These new peaks may be due to cluster defects containing boron. (auth)

32898 ELECTRON SPIN RESONANCE AND OPTICAL ABSORPTION OF DEFECTS IN THE INORGANIC AZIDES. Owens, F. J. (Picatinny Arsenal, Dover, NJ). Radiat. Eff.; 21: No. 1, 1-17(1974).

Electron spin resonance and optical absorption studies of defects in the inorganic azides are reviewed. The various proposed models for the different data are discussed and the detailed electronic structure of the defect is considered. Comparisons of the properties of the same defect in different azide lattices are made. Remaining proposed models are pointed out. Thermoluminescence and infra-red studies of irradiated azides are briefly considered. (auth)

32899 ELECTRIC QUADRUPOLE INTERACTIONS OF ^{20}F IN MgF_2 SINGLE CRYSTALS. Stoeckmann, H. J.; Ackermann, H.; Dubbers, D.; Grupp, M.; Heitjans, P. (Heidelberg Univ. (F.R. Germany). 1. Physikalisches Inst.). Z. Phys.; 269: No. 1, 47-57 (1974). (In German).

10 figs.; 1 tab.; 28 refs.

Polarized ^{20}F nuclei (T_h = 11s, I = 2) were produced in a tetragonal MgF_2 single crystal by capture of polarized neutrons. Nuclear magnetic resonance transitions were induced and observed via the asymmetric β decay to ^{20}Ne, yielding the quadrupole coupling constant e^2qQ h = 5.77(2) MHz, the quadrupole moment Q(^{20}F) = 0.064(12)b and the asymmetry parameter of the electric field gradient eta = 0.317(2). In order to study possible lattice defects produced by the recoil displacement due to the capture γ-rays, NMR signals were registered both at room temperature and at 12°K. Width and depth of the resonance curves indicated that at room temperature nearly all ^{20}F ions occupy normal lattice sites with an undisturbed environment. At 12°K, however, where no annealing occurs, this is only true for about half of the ^{20}F ions which are stopped directly at defect free sites. The other half of the ^{20}F ions at 12°K shows resonance frequencies shifted by defect interactions up to the order of some 100 kHz. Furthermore, two simple methods are reported which allow a quick estimate of the strength of the quadrupolar interaction: (1) observation of the β decay asymmetry versus the magnetic field strength (decoupling curve), and (2) broad-band modulation of the induced rf field and observation of the β asymmetry versus the depth of the modulation. (auth)

32900 MATERIAL FOR THE PREPARATION OF NEUTRON ABSORBERS. Vobecky, M. Czech Patent 146,515. 15 Dec 1972. Filed date 21 Jan 1972.

The material consists of 0.05 to 95.00 wt% Cd powder and/or a mixture of Cd compounds and of 5 to 99.95 wt% plastics. The plastics may include substances such as polyethylene, polypropylene, polyisobutylene, polystyrene, polymethyl methacrylate, and polyethylene teraphthalate. A satisfactory density of target nuclei may be produced by the homogeneous dispersion of the powder target nuclide in the elemental form or in the form of a suitable compound or a mixture of compounds, in a plastic. If the target substance in the absorbing material is diluted using a filler, i.e., a plastic, the effect of self-shielding is suppressed in those nuclei which exhibit high neutron absorption values, e.g., Dy, Gd, Au, etc. The material also has good mechanical properties. (Nucl. Sci. Abstr. Czech.)

32901 INELASTIC NEUTRON SCATTERING BY CERIUM HYDRIDES. II. Lattice Dynamical Approach. Vorderwisch, P. (Hahn-Meitner-Institut fuer Kernforschung, Berlin); Hautecler, S.; Deckers, H. Phys. Status Solidi (b); 65: No.1, 171-180(1 Sep 1974).

A central force lattice dynamical model, previously applied by Slaggie to the CaF_2 structure of ZrH_2, is extended to the BiF_3 structure and used for the analysis of inelastic neutron scattering data on $CeH_{1.98}$ and $CeH_{2.72}$. For both samples the force constants are derived. The values of the corresponding force constants in both hydrides are different. The additional hydrogen in the CeH_2 structure is found to be weakly bound. (auth)

32902 INFLUENCE OF DEFECTS ON POSITRON ANNIHILATION IN ALKALI-HALIDES. Smedskjaer, L.; Dannefaer, S.; Cotterill, R. M. J.; Trumpy, G. (Danmarks Tekniske Hoejskole, Lyngby). J. Phys. (Paris), Colloq.; No. 9, 97-99(1973).

From first international conference on lattice defects in ionic crystals; Marseilles, France (2 Jul 1973).

Results are presented for: additively colored NaCl and KCl single crystals; F to F^- conversion; thermal quenching; radiation damage. They show that F centers are effective as traps for positrons by the presence of a new 1.1-ns lifetime, and that trapping probability is proportional to the density of F centers, and further that F to F^- conversion decreases this probability. The introduction of defects by thermal treatment causes considerable changes in the annihilation spectra, and this defect influence on stage I coloration is also revealed in angular correlation measurements. Stage I coloration takes place in a thin surface layer (in NaCl) within approximately four hours using a 1-mCi ^{22}Na source. (FR)

32903 MAGNETIC TRANSITIONS IN THE UP-USe SYSTEM. Leciejewicz, J. (Swierk Research Establishment, Otwock, Poland); Troc, R.; Palewski, T. Phys. Status Solidi (b); 65: No. 1, K57-K61(1 Sep 1974).

A neutron diffraction study was performed on sintered $UP_{1-x}Se_x$ solid solutions. Results show a marked change in the magnitude of magnetic moment in all the compositions with IA type magnetic ordering. This transition occurs at ~60°K. (DLC)

32904 MAGNETIC SUSCEPTIBILITY OF UP AND UAs. Troc, R. (Inst. of Low Temperature and Structure Research, Wroclaw); Lam, D. J. Phys. Status Solidi (b); 65: No. 1, 317-324(1 Sep 1974).

The magnetic susceptibility of UP and UAs was measured as a function of temperature from 4.2 to 1000°K and results are compared with published results. From the temperature dependence of the magnetic susceptibility, the most likely $5f^3$ electronic configuration of the uranium ion in these two compounds are deduced using a nonperturbative (full J-mixing) crystal-field theory. (5 fig, 3 tables, 28 references) (auth)

32905 AMORPHOUS AND LIQUID SEMICONDUCTORS. Proceedings of the Fifth International Conference, Garmisch-Partenkirchen, Germany, September 3–8, 1973. Stuke, J.; Brenig, W. (eds.). London; Taylor and Francis Ltd. (1974). 1443p.

One hundred and eighty four papers were presented in plenary sessions and in sections entitled: structure and characterization of materials; theory; electrical properties; optical properties; devices; alloys; resonance effects and magnetic properties; low temperature phenomena; phonons; special topics. A paper on ionic radiation effects in amorphous solids was abstracted separately. (UK)

For an abstract of an individual paper see: 32906.

32906 USE OF ION BOMBARDMENT TO STUDY AMORPHOUS SOLIDS. Olley, J. A.; Yoffe, A. D. (Cambridge Univ., Eng.). pp 73-78 of Amorphous and Liquid Semiconductors. Stuke, J. (ed.). London; Taylor and Francis Ltd. (1974).

From fifth international conference on amorphous and liquid semiconductors; Garmisch-Partenkirchen, Germany (3 Sep 1973).

An important technique for the study of the physical properties of amorphous solids is discussed. Disorder and high concentrations of structural defects can be introduced into both crystalline and amorphous solids by bombardment with heavy ions (of energy ~100 keV), especially if the bombardment is carried out at low temperatures. This facility can be used in two ways to study the physical properties of amorphous solids. By increasing the concentration of structural defects in amorphous solids the dependence of characteristic electronic properties upon such defects can be determined, also, it is possible to produce amorphous films by bombardment of single crystalline films. Since the crystalline solid state is understood fairly well, by following various physical properties as disorder is built up during the crystalline to amorphous transformation, something can be learned about the origins of the characteristic properties of amorphous solids. The potential of these techniques is demonstrated by three important results: the dependence of the $T^{-\frac{1}{2}}$ type conductivity upon structural defects has been demonstrated; evidence of the cause of the Urbach type absorption edge in amorphous semiconductors has been found; and finally evidence has been obtained for the existence of a minimum metallic conductivity in amorphous solids. (auth)

32907 H CENTRES IN ALKALINE-EARTH FLUORIDES. Hayes, W.; Lambourn, R. F.; Stott, J. P. (Oxford Univ.). J. Phys., C (London); 7: No. 14, 2429-2433(21 Jul 1974).

It is shown by EPR methods that H centers are produced in alkaline earth fluorides by heavy irradiation with electrons at low temperatures and it is suggested that a very inefficient intrinsic process of radiolysis is involved. From structure observed in the EPR spectrum in SrF_2 it appears that H centers may be stabilized at other defect sites and that observed effects of intrinsic radiolysis may be controlled to some extent by impurities. (auth)

32908 LATTICE LOCATION AND ATOMIC MOBILITY OF IMPLANTED BORON IN SILICON. Frank, W. F. J.; Berry, B. S. (IBM Watson Research Center, Yorktown Heights, NY). Radiat. Eff.; 21: No. 2, 105-111(1974).

A unifying interpretation is presented for a number of different studies concerned with the lattice location and diffusivity of boron implanted into silicon. It is suggested that the nonsubstitutional boron present after a room temperature implantation consists mostly of boron-vacancy complexes, together with a relatively small number of boron interstitials. The boron interstitials anneal at 200 to 300°C without long-range migration, whereas the boron-vacancy complexes are thermally very stable (possibly due to an extended defect configuration) and anneal to produce substitutional boron atoms only at high temperatures where silicon self-interstitials take over as the dominant intrinsic point defect. This model explains numerous experimental observations in a manner which both reconciles a number of apparent conflicts between different types of experiment, and is consistent with an interstitial mechanism for Si self-diffusion and boron diffusion in silicon at high temperatures. (auth)

32909 INTERSTITIAL PROPERTIES DEDUCED FROM INTERNAL FRICTION MEASUREMENTS ON BORON-IMPLANTED SILICON. Frank, W. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Radiat. Eff.; 21: No. 2, 119-133(1974).

Internal friction measurements on boron-implanted silicon recently performed by Tan and Berry are analyzed in terms of self- and boron-interstitial properties. It is shown that the observed internal friction peaks can be assigned to the reorientation of electrically neutral and singly negatively charged ⟨100⟩-split boron-interstitials and of singly positively charged ⟨100⟩-split and electrically neutral ⟨100⟩-split silicon self-interstitials. An empirical relation between the measured activation energies of reorientation of these defects and their electronic properties is suggested and used to get information about the distribution of the electrical charge of these interstitials. A self-consistent set of values for the migration energies of boron- and self-interstitials and for the activation energies of local decay of boron-interstitials is presented. The results support and extend a model of the properties of self-interstitials in elemental semiconductors suggested previously by Seeger and Frank. (auth)

32910 COMPTON PROFILE OF SOLID o-H_2. Doni, E.; Parravicini, G. P. (Univ., Pisa, Italy). Phil. Mag.; 30: No. 1, 203-206(Jul 1974).

The isotropic Compton profile of solid o-H_2 is calculated, using the molecular tight-binding method and taking the overlap integrals into account. It is shown that solid-state effects are small but not negligible. (auth)

32911 LIGHT ION IRRADIATION EXPERIMENTS SUGGEST AN IONIZATION DAMAGE MECHANISM FOR SILICON. Pabst, H. J.; Palmer, D. W. (Univ. of Sussex, Brighton, Eng.). Radiat. Eff.; 21: No. 2, 135-136(1974).

In studies of ion-irradiation effects in silicon it has been usually assumed that initial elastic ion-atom collisions are responsible for defect production. The results now reported for light-ion irradiation of silicon suggest that inelastic, ionization effects can be important. Channeling irradiation experiments were carried out with 300 keV H^+ and 275 keV He^+ ions on p-type silicon single crystals in the temperature range 80 to 300°K for the ⟨110⟩ channeling direction. The observed initial changes in scattering yield with irradiation dose are set out in a table which gives ion species, irradiation temperature, and yield changes per μC irradiation in percent. The results are discussed, and the conclusion is drawn that ionization effects are important in producing defects. (UK)

32912 TRAPPING AND EMISSION CENTRES IN THERMOLUMINESCENT BARIUM SULPHATE. Gupta, N. M.; Luthra, J. M.; Shankar, J. (Bhabha Atomic Research Center, Bombay). Radiat. Eff.; 21: No. 3, 151-156(Mar 1974).

The nature of trapping and emission centers in various impurity doped $BaSO_4$ phosphors has been investigated by thermoluminescence (glow curves and emission spectra) and ESR techniques. The results indicate that anion radicals (such as SO_4^-, SO_3^-, and O_3^-) that act as trapped hole centers are formed by γ-irradiation. It has been found that corresponding to the temperatures at which the centers are annihilated there are glow peaks in the TL curves. It is, therefore, suggested that the thermally released holes from each of such centers are mobile and recombine at some trapped electron centers. The energy thus released excites the impurity ion present, which on returning to the normal state gives its characteristic emission. (auth)

32913 FORMATION OF DEFECTS IN MUSCOVITE MICA SPECIMENS IRRADIATED BY HIGH ENERGY IONS. Dartyge, E.; Lambert, M. (Paris Univ., Orsay, France). Radiat. Eff.; 21: No. 2, 71-79(1974). (In French).

Muscovite mica samples are studied by low angle scattering of x-rays, after irradiation by krypton, argon, and neon ions with an energy of 1 MeV/nucleon and oxygen ions of 2 and 5 MeV/nucleon. Both point defects and larger defects are formed along the path of the ion; the latter defects have radii varying from 10 to 30 Å depending upon the type of incident ion. These large defects comprise the "latent tracks" which yield the visible tracks after etching. Their concentration is great enough at large irradiations (10^{14} to 10^{15} ions/cm^2) for the mica to become amorphous. (auth)

32914 MAGNETIC SUSCEPTIBILITY OF γ-IRRADIATED SINGLE CRYSTALS OF MAGNESIUM FLUORIDE. Van Den Bosch, A. (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). Radiat. Eff.; 21: No. 2, 113-118(1974).

Data of static magnetic susceptibility measurements on γ-irradiated single crystals of magnesium fluoride are reported for doses up to 1×10^{11} rad. The susceptibility was interpreted to consist of three parts: (1) a diamagnetic part $\chi_d = -0.384 \times 10^{-6}$ emu/g, due to the normal MgF_2 matrix; (2) a temperature-dependent paramagnetic part, obeying the Curie law, arising from unpaired electrons; and (3) a temperature-independent paramagnetic part which is attributed to the presence of metallic magnesium. The results show that the radiation damage process in MgF_2 is strikingly similar to that in LiF. (auth)

32915 FIZICHESKAYA KHIMIYA POLIMERNYKH KOMPOZITSII. (Physical Chemistry of Polymer Compositions). Lipatov, Yu. S. (ed.). Kiev; Izdatel'stvo Naukova Dumka (1974). 184p.

The results of theoretical and experimental studies in the area of adsorption of polymers, adhesion, thermodynamic surface phenomena, structure formation in dispersed systems, and interaction of polymers and fillers were reported in a compilation of 30 articles. An individual abstract was prepared for one article. (JSR)

For an abstract of an individual paper see: 32916.

32916 EFFECT OF γ RADIATION ON THE THERMO-MECHANICAL PROPERTIES OF METALLOPOLYMERS BASED ON POLYCAPROAMIDE AND HIGHLY DISPERSED IRON, COBALT, NICKEL, AND COPPER. Khimchenko, Yu. I.; Radkevich, L. S.; Natanson, E. M.; Meleshevich, A. P. (Inst. of Colloidal Chemistry and Chemistry of Water, Kharkov). pp 150-154 of Fizicheskaya Khimiya Polimernykh Kompozitsii. Lipatov, Yu. S. (ed.). Kiev; Izdatel'stvo Naukova Dumka (1974). (In Russian)

The effect of γ radiation on the thermo-mechanical properties of metallopolymers was studied. It was established that the effect of γ radiation on these characteristics of the metallopolymers is determined basically by the nature of the metal in the metallopolymer and its concentration. It was shown that γ radiation leads to a reduction of the softening temperature and the flow temperature, particularly for metallopolymers of Cu and Ni. (tr-auth)

32917 TETRAHEDRALLY BONDED AMORPHOUS SEMICONDUCTORS. International Conference Held at Yorktown Heights, New York, March 20–22, 1974. Brodsky, M. H.; Kirkpatrick, S.; Weaire, D. (eds.). AIP Conference Proceedings, Number 20. New York; American Institute of Physics (1974). 383p. (CONF-740313–).

A total of 57 papers are presented, arranged according to: edge and gap states; electronic states (bands and core levels); structure; vibrations; and transport. A separate abstract was prepared for one paper. (DLC)

For an abstract of an individual paper see: 32829.

32918 ELECTRON ENERGY LOSSES IN THIN GRAPHITE LAYERS ON THE (111) FACE OF NICKEL. Patil, H. R.; Blakely, J. M. (Cornell Univ., Ithaca, NY). J. Appl. Phys.; 45: No. 9, 3806-3808(Sep 1974).

Equally spaced multiple losses of 29 ± 1 eV were observed accompanying 700–1500-eV electrons elastically reflected from epitaxial graphite layers formed by segregation to a Ni(111) surface. Both the loss spectra and the structure in the "true secondary" region from the thin segregated layers were indistinguishable from those obtained with bulk pyrolytic graphite. The relative loss peak intensities agree well with the theoretical predictions of Lucas and Sunjic. (auth)

32919 RADIATION DAMAGE IN METAL-SEMICONDUCTOR TUNNEL JUNCTIONS. Darley, H. M. Lexington, KY; Univ. of Kentucky (1973). 206p. University Microfilms Order No. 74-19,611.

Thesis (Ph. D.).

Metal-semiconductor tunnel junctions were irradiated at room temperature with a 3-MeV proton beam. The effects on the current vs voltage characteristics were studied. The samples were prepared by cleaving degenerate Ge:As in a vacuum in a stream of evaporating indium as the metal. Contact to the metal was made through photoresist techniques. The current–voltage characteristics of the junctions were studied at 4.2°K by plotting the incremental resistance (dV/dI) versus the voltage. Radiation flux and temperature were monitored during irradiation. Supplementary magnetic field studies and superconducting tests were also made. Changes in the incremental resistance curves with radiation dosage can be categorized as follows: (1) increase in resistance, (2) reduction of the Fermi level, (3) growth of a zero bias anomaly at certain stages, (4) a broadening or flattening of the characteristic curve, (5) appearance of structures for forward bias in the form of small irregular peaks, (6) reduction of the strength of the phonon structure. It was found that the current can be broken down into two primary components one-step elastic current and two-step resonant elastic current. The one-step current accounts for almost all the current in the unirradiated junctions and junctions with only a small dosage. The two-step contribution is initially unobservable but dominates for samples which have undergone heavy irradiation. However, the defects states associated with the two-step tunneling can anneal leaving primarily the one-step current. For the one-step tunneling, a model based on the reported acceptor levels of the defects introduced by irradiation was developed. These levels are located at $E_c - .2$ eV and $E_v + .26$ eV. This model accounted for the increase in resistance, the Fermi level reduction, but the fit to the secondary changes of shape is inconclusive due to the presence of two-step tunneling. The present theory of two-step tunneling was extended and applied to a metal semiconductor junction with radiation damage. The theoretical results predicted the large zero bias anomaly observed when two-step tunneling dominated. It also predicted that the tunneling would be through the $E_c - .2$ eV states which was confirmed by the radiation annealing results. The theory predicted a large step at the Fermi level which was not observed. (DLC)

32920 EFFECTS OF GAMMA-RADIATION ON HYDROGEN-IMPREGNATED GLASS: ELECTRON PARAMAGNETIC RESONANCE AND OPTICAL SPECTROSCOPIC ANALYSIS. DiSlavo, R. University Park, PA; Pennsylvania State Univ. (1973). 160p. University Microfilms Order No. 74-20,914.

Thesis (Ph.D.).

Hydrogen impregnation as a method of preventing radiation-induced discoloration of glass was investigated. Gaseous hydrogen was incorporated into Pyrex brand glass up to 4.0 mole % without substantially altering the structure of the glass. Glass specimens were exposed to γ-radiation from a ^{60}Co source in doses ranging up to 2×10^5 R. Using EPR, four types of color centers were observed in irradiated Pyrex: the boron-oxygen hole center (BOHC, g = 2.016), the aluminum-oxygen hole center (AlOHC, g = 2.010), the oxygen vacancy center (OVC, g = 1.949), and the silicon electron center (SiEC, g = 2.001). Color center concentrations were determined as a function of radiation dose and hydrogen content. Growth curves show an initial rapid rise in color center concentration followed by a much slower rate of increase. The BOHC was found to be the color center present in the largest concentration (~90% of the total color centers present) in irradiated untreated Pyrex. The impregnation process is capable of decreasing the BOHC concentration by up to four orders of magnitude. The concentrations of the AlOHC and the SiEC are also reduced significantly, while that of the OVC is increased very slightly. Uv, visible, and ir absorption spectroscopy and laser Raman spectroscopy aided in color center characterization. The absorbance of the irradiated glasses in the near uv and visible regions decreases significantly with increasing hydrogen content. The EPR signals of the BOHC and the OVC were correlated with absorption bands at 314 nm and 256 nm respectively. Raman spectra have shown similarities in the vibrational characters of Pyrex and fused SiO_2. A broad fluorescence band was detected in the irradiated glasses. The intensity of this band decreases with increasing hydrogen content. A band gap model has been proposed to relate the formation of stable color centers to the glass structure. Ir spectroscopy was used to monitor the hydroxyl content of the glasses before and after impregnation and irradiation. Impregnation is observed to increase the hydroxyl content only slightly. However, irradiation of hydrogen-containing glasses produces large increases in hydroxyl content. Based on experimental evidence, mechanisms are proposed to account for the formation of the BOHC and its subsequent destruction by hydrogen. The structural model of the BOHC which places the trapped hole on a nonbridging oxygen bound to a network-forming boron atom was found to be most consistent with experimental results. A generalized mechanism for the destruction of color centers by hydrogen is proposed and is felt to be applicable to a wide variety of vitreous systems. (DLC)

32921 CHARGE STORAGE IN SiO_2 UNDER LOW-ENERGY ELECTRON BOMBARDMENT. Fanet, J. M.; Poirier, R. (Thomson-CSF, Domaine de Corbeville, Orsay, France). Appl. Phys. Lett.; 25: No. 4, 183-185(15 Aug 1974).

Low-energy (≈10 eV) electron bombardment on an SiO_2 layer gives rise to strong trapping at the surface and to a positive space-charge build-up near the $Si-SiO_2$ interface. The density, the capture cross section, and the energy level of the traps were evaluated using, respectively, the constant current charging process and the quantum yield of vacuum photoemission versus wavelength. (auth)

32922 MOBILITY IN EPITAXIAL GaAs UNDER 1-MeV ELECTRON IRRADIATION. Dresner, J. (RCA Labs., Princeton, NJ). J. Appl. Phys.; 45: No. 9, 4118-4119(Sep 1974).

Vapor-grown epitaxial layers of undoped n-type GaAs show an anomalous large decrease in apparent mobility upon irradiation with a small dose of 1-MeV electrons. As the dose is increased, the samples become p type. Results cannot be accounted for by a uniform distribution of radiation-induced point defects. It is proposed that spatial inhomogeneity is induced by the irradiation. A possible mechanism is the ionization-induced migration of deep donors to a network of dislocations in the layer. This migration can be reversed by annealing. (auth)

32923 EFFECT OF NEUTRON RADIATION AND γ RADIATION ON THE PARAMETERS OF METAL-INSULATOR-SEMI-

CONDUCTOR STRUCTURES. Girii, V. A.; Pasechnik, V. M.; Stepanenko, V. A.; Khrapachevskii, V. N.; Shakhovtsov, V. I. Sov. At. Energy (Engl. Transl.); 35: No. 1, 663-664(Jul 1973).

Translated from At. Energ. (USSR); 35: No. 1, 48-49(Jul 1973). This is a summary of paper No. 675/6977 with full copy held at TIC.

Radiation effects on the behavior of P-channel Si–SiO_2–Si_3N_4–Al metal–insulator–semiconductor (MIS) structures were investigated. It was found that gamma radiation causes variations in threshold voltage in these compounds. The ionization character of the radiation effects is also demonstrated. (JRD)

32924 CRITICAL ANGLES AND MINIMUM YIELDS FOR PLANAR CHANNELING. Roosendaal, H. E.; Kool, W. H.; van der Weg, W. F.; Sanders, J. B. (Stichting voor Fundamental Onderzoek der Materie, Amsterdam). Radiat. Eff.; 22: No. 2, 89-99(Jun 1974).

Measurements of the planar channeling of 120, 160, and 190 keV protons in Si, for a variety of atomic planes are presented. The observed half-angles at half minimum $\psi_{1/2}$ turn out to be proportional to $E^{-\frac{1}{2}}$ in this restricted energy range and show an almost linear dependence on the planar spacing d_p. The minimum yield χ_{min} is found to be proportional to d_p^{-1}, whereas the dechanneling as a function of the depth of scattering shows a strong dependence on d_p. Comparing the results with results of other authors no energy dependence of χ_{min} is observed. An analytical model is developed, including the effects of surface transmission and thermal vibrations, in which the half-angles at half-minimum $\chi_{\frac{1}{2}}$ and the minimum yield χ_{min} are treated in a consistent way. The results of this model agree well with the experimental data, as well as with results of other authors for a variety of projectile target combinations. In addition the stopping power near the planes is obtained yielding values 3 to 5 times higher than for random incidence. (auth)

32925 ANNEALING OF DEFECTS AT HIGH TEMPERATURE IRRADIATION OF SILICON BY ACCELERATED IONS. Lebedev, S. Ya.; Omelyanovskaya, N. M. (Inst. of Physics and Power Engineering, Obninsk, USSR). Radiat. Eff.; 22: No. 2, 135-137 (June 1974).

Angular and temperature dependences of ion-electron emission coefficient γ at bombardment of the (111) face of Si monocrystal by Ar^+ ions with the energy of 70 keV and by Kr^+ ions with the energy of 30 keV were studied. Two "annealing stages" of radiation defects were observed under irradiation: at T^0 of the order of 400°C, when annealing of the near-surface amorphized layer takes place under irradiation, and at temperatures above 600°C ($T = 0.52$ of the melting temperature). It is shown that in contrast to the first stage of defect annealing, the second "stage" does not cause changes of the $\gamma = \gamma(\varphi)$ angular dependence type (φ is the angle of ion beam incidence onto a crystal surface) and leads only to a decrease of γ value. This phenomenon is connected with the process of considerable density formation of high temperature structure defects resulting in electron capture. The significance of crystal surface is underlined in the formation of these capture centers, as well as considerable analogy with Ge crystal behavior. (auth)

32926 STRUCTURAL TRANSITIONS IN ION-IMPLANTED DIAMOND. Vavilov, V. S.; Krasnopevtsev, V. V.; Miljutin, Yu. V.; Gorodetskii, A.; Zakharov, A. P. (Inst. of Physics, Moscow). Radiat. Eff.; 22: No. 2, 141-143(Jun 1974).

Natural diamond was implanted with 40-keV argon ions at room temperature and with fluences 6×10^{13} to 2.4×10^{15} cm^{-2}. The crystal structure of implanted layers was studied and the results are presented. (auth)

32927 EFFECT OF GAMMA IRRADIATION ON CARBON FIBRE PROPERTIES. Sharp, J. V.; Burnay, S. G. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Radiat. Eff.; 22: No. 1, 45-48(May 1974).

Carbon fibers heat treated to temperatures in the range 1000 to 2600°C were irradiated in a spent fuel pond to gamma doses between 1 to 1000 Megarads (Mr). The mechanical properties of the irradiated fibers were determined by single filament tests. There is a reduction in strength and modulus for fibers irradiated in air, probably due to radiation enhanced oxidation effects. This produces an increase in fiber diameter ($\lesssim 10\%$) for fiber originally heat treated to 1000 and 1500°C. This is probably due to fine scale voidage (~20 Å) for which there is some evidence in thin sections prepared from regions close to the surface of these fibers (irradiated to 1000 Mr). The mechanical properties of fibers irradiated to 1000 Mr in argon were unaffected by the irradiation showing that the displacement damage from the irradiation has had little effect on the processes controlling modulus and strength. (auth)

32928 ELECTRICAL ACTIVITY AND RADIATION DAMAGE IN ION IMPLANTED CADMIUM TELLURIDE. Gettings, M.; Stephens, K. G. (Univ. of Surrey, Guildford, Eng.). Radiat. Eff.; 22: No. 1, 53-62(May 1974).

Single crystals of semi-insulating cadmium telluride have been implanted with 50 keV argon ions and 100 keV indium, tellurium and bismuth ions in an attempt to reduce the resistivity of the implanted layer by the injection of free carriers. Carrier concentrations were determined from sheet resistivity and Hall measurements. The highest percentage ($\simeq 30\%$) of electrically active ions to the total number implanted was measured for a dose of 10^{14} indium ions/cm^2 implanted into a substrate held at 200°C. Although some activity was generated by bismuth ions, tellurium and argon ions produced no measurable electrical changes. The backscattering and channelling of helium ions was used to study the damage produced by the different ions under different implant and annealing conditions. The technique was also used to measure the bismuth atom concentration retained by samples after various annealing stages. Some of the increases in electrical activity could be correlated with reductions in radiation damage. Above annealing temperatures of 400°C however, the increases in lattice disorder and sample resistivities were probably due to thermally generated active defects and loss of the implanted ion species. (auth)

32929 PARTIAL DISINTEGRATION AND CHANGE OF CONCENTRATION PROFILES AT ION BOMBARDED Na SILICATE GLASS SURFACES. Bach, H. (Jenaer Glaswerk Schott und Gen., Mainz). Radiat. Eff.; 22: No. 2, 73-78(Jun 1974).

From the observation of the change of photon emission intensities of sputtered excited atoms from glass surfaces by applying an ion beam of 5.6 keV Ar^+ ions, the influence of the bond energy of the different atoms in the target on the sputtering behavior can be investigated. Differences of bond energy constitute different masses effective in the collision cascade, which is developed by the impinging ions below the glass surface. The probability for sputtering of more weakly bound atoms in an excited state or for a transport of these atoms to deeper layers below the surface, depends on the angle of incidence β of the projectile ions. This is illustrated for Na atoms and Si atoms displaced in the collision cascade spread below the bombarded surface in the silica rich network of $Na_2O.4SiO_2$ glass by recording the changes of intensity of photon emission of the excited Na(I) and Si(III) lines. The Na concentration in thin layers at the surface of the ion bombarded glass is decreased during sputtering. The change of the energy spread in the collision cascade below the surface connected with the change of β causes maxima and minima in the recordings of the photon emission intensity observed during continuous ablation. The period of time which is needed for these changes indicated by these extrema immediately after a change of β depends on the amount of the change of β and on the bond energy of the constituents or on the effective masses M_2 respectively in the glass target. This period characterizes therefore the short range order of this glass target with respect to the bonding of the constituents. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

Refer also to abstracts 31475, 31532, 34035, 34152, and 34316.

32930 (REG/G-5.37(8-74)) IN SITU ASSAY OF ENRICHED URANIUM RESIDUAL HOLDUP. (USAEC Directorate of Regulatory Standards, Washington, D.C.). Aug 1974. 8p. DRS Free.

Part 70 of Title 10 of the Code of Federal Regulations requires each licensee, authorized to possess more than 350 g of contained ^{235}U, to conduct a physical inventory of all special nuclear material in his possession at intervals not to exceed 12 months. Certain licensees authorized to possess more than one effective kilogram of special nuclear material are required to conduct measured physical inventories of their special nuclear materials more frequently than annually depending on the materials. Enriched uranium residual holdup is defined as the inventory component remaining in and about process equipment and handling areas after those collection areas have been prepared for inventory. Whenever possible, process equipment should be designed and operated so as to minimize the amount of holdup. This guide describes procedures acceptable to the Regulatory staff for the in situ assay of the residual uranium holdup using gamma ray spectroscopy. (TFD)

32931 (REG/G-5.38(9-74)) NONDESTRUCTIVE ASSAY OF HIGH-ENRICHMENT URANIUM FUEL PLATES BY GAMMA RAY SPECTROMETRY. (USAEC Directorate of Regulatory Standards, Washington, D.C.). Sep 1974. 7p. DRS Free.

Part 70 of Title 10 of the Code of Federal Regulations requires each licensee authorized to possess more than 350 g of contained ^{235}U to conduct a physical inventory of all special nuclear material in his possession at intervals not to exceed 12 months. Each licensee authorized to possess more than one effective kilogram of high-enrichment uranium is required to conduct measured physical inventories of his special nuclear materials at bimonthly intervals. For certain nuclear reactors, the fuel consists of highly enriched uranium fabricated into flat of bowed plates. Typically, these plates are relatively thin so that a significant percentage of ^{235}U gamma rays penetrate the fuel cladding. When the measurement conditions are properly controlled and corrections are made for variations in the attenuation of the gamma rays, a measurement of the ^{235}U gamma rays can be used as an acceptable measurement of the distribution and the total ^{235}U content of each fuel plate. In lieu of assaying the product fuel plates, fuel plate core compacts may be assayed through the procedures detailed in this guide, provided steps are taken to ensure the traceability and integrity of encapsulation of each assayed fuel plate core compact. This guide describes features of a gamma ray spectrometry system acceptable to the Regulatory staff for nondestructive assay of high-enrichment uranium fuel plates or fuel plate core compacts. (TFD)

32932 (TID-26634) DRAFT STANDARD FORMAT AND CONTENT FOR THE SPECIAL NUCLEAR MATERIALS CONTROL AND ACCOUNTING SECTION OF THE LICENSE APPLICATION FOR THE FUEL REPROCESSING AND CERTAIN SPECIAL NUCLEAR MATERIALS FACILITIES. Report No. 139. (Nuclear Surveillance and Auditing Corp., Falls Church, Va. (USA)). 13 Dec 1973. 97p. Dep. NTIS $8.00.

The objective of a standard format is to expedite the processing of an application and to reduce delays resulting from incomplete applications and supplemental correspondence. This Standard Format provides a definition of the significant features by which an adequate first submission might be prepared. Further, use of a standard format contributes to the establishment of a common basis for license applications which is of material assistance to an orderly review and judgment by AEC Regulatory Staff. (TFD)

32933 (TID-26635) DRAFT STANDARD FORMAT AND CONTENT OF PHYSICAL PROTECTION SECTION OF LICENSE APPLICATION FOR FUEL REPROCESSING AND CERTAIN SPECIAL NUCLEAR MATERIAL FACILITIES. Report No. 141. (Nuclear Surveillance and Auditing Corp., Falls Church, Va. (USA)). 19 Dec 1973. 115p. Dep. NTIS $8.75.

The objective of a standard format is to expedite the processing of an application and to reduce delays resulting from incomplete applications and supplemental correspondence. This "Standard Format and Content of the Physical Protection Section of License Applications" identifies the principal information needed by the regulatory staff to evaluate the adequacy of physical security plans for facilities other than nuclear power reactors; the information needed to evaluate physical security plans for protection of SNM at fixed sites; and the information needed with respect to plans for the physical protection of SNM in transit. (TFD)

32934 PROTECTION OF SPECIAL NUCLEAR MATERIALS AND FACILITIES. Conference Held at Key Largo, Florida, February 18–21, 1973. New York; Atomic Industrial Forum, Inc. (1973). vp. (CONF-730231-).

A separate abstract was prepared for each of the eleven papers presented at the conference. (TFD)

For abstracts of individual papers see: 32935–32945.

32935 MATERIALS AND PLANT PROTECTION: REGULATORY POLICY OVERVIEW. Case, E. G. (Atomic Energy Commission, Washington, DC). pp Paper 1 of Protection of Special Nuclear Materials and Facilities. New York; Atomic Industrial Forum, Inc. (1973).

From protection of special nuclear materials and facilities workshop; Key Largo, Florida, USA (18 Feb 1973). See CONF-730231-.

An overview of AEC requirements with respect to the safeguarding of special nuclear materials at nuclear facilities is presented. The major topics covered include: sabotage protection of nuclear power reactors; sabotage protection of fuel cycle facilities; materials protection at nuclear facilities; and materials protection in transit. Some proposed regulatory changes that would strengthen the safeguards program are discussed. (TFD)

32936 INDUSTRIAL GUIDELINES TO MATERIALS PROTECTION. VanHoomissen, J. E. pp Paper 2 of Protection of Special Nuclear Materials and Facilities. New York; Atomic Industrial Forum, Inc. (1973).

From protection of special nuclear materials and facilities workshop; Key Largo, Florida, USA (18 Feb 1973). See CONF-730231-.

Broad considerations of physical protection involved in nuclear industry activities are set forth. These considerations include site selection, general plant design, internal operations at a nuclear plant, and some comments about transportation of nuclear materials between plant sites. (TFD)

32937 ANALYSIS OF IAEA RECOMMENDATIONS FOR THE PHYSICAL PROTECTION OF NUCLEAR MATERIALS. Crowson, D. L. (Atomic Energy Commission, Washington, DC). pp Paper 3 of Protection of Special Nuclear Materials and Facilities. New York; Atomic Industrial Forum, Inc. (1973).

From protection of special nuclear materials and facilities workshop; Key Largo, Florida, USA (18 Feb 1973). See CONF-730231-.

The role of the IAEA safeguards recommendations in preventing and detecting nuclear materials diversion is examined. (TFD)

32938 PHYSICAL SECURITY OF SPECIAL NUCLEAR MATERIALS ON THE OPERATING FLOOR. Moncrief, E. C. pp Paper 4 of Protection of Special Nuclear Materials and Facilities. New York; Atomic Industrial Forum, Inc. (1973).

From protection of special nuclear materials and facilities workshop; Key Largo, Florida, USA (18 Feb 1973). See CONF-730231-.

The physical protection measures employed at Nuclear Materials and Equipment Corporation for safeguarding special nuclear materials are described. (TFD)

32939 NUCLEAR MATERIAL IN STORAGE: PLANNING A PROTECTION PROGRAM. Low, L. D. pp Paper 5 of Protection of Special Nuclear Materials and Facilities. New York; Atomic Industrial Forum, Inc. (1973).

From protection of special nuclear materials and facilities workshop; Key Largo, Florida, USA (18 Feb 1973). See CONF-730231-.

The planning of a physical protection program for nuclear facilities from the standpoint of sabotage, theft or diversion is discussed. The topics covered include security areas, physical barriers, access control, security force, surveillance, local law enforcement liaison, and off-site communication. (TFD)

32940 NUCLEAR MATERIAL IN TRANSIT. Physical Protection and the New Proposed AEC Regulations. Edlow, J. pp Paper 6 of Protection of Special Nuclear Materials and Facilities. New York; Atomic Industrial Forum, Inc. (1973).

From protection of special nuclear materials and facilities workshop; Key Largo, Florida, USA (18 Feb 1973). See CONF-730231-.

The proposed regulations, published in the Federal Register

on Feb. 1, 1973, designed to strengthen the safeguards of special nuclear materials during transport are described and discussed. The paper is generally critical of the regulations and approaches a cost-benefit analysis. Some alternative protection procedures are discussed. (TFD)

32941 MATERIALS AND PLANT PROTECTION: AEC REQUIREMENTS AND LICENSING EVALUATION. Page, R. G. (Atomic Energy Commission, Washington, DC). pp Paper 7 of Protection of Special Nuclear Materials and Facilities. New York; Atomic Industrial Forum, Inc. (1973).

From protection of special nuclear materials and facilities workship; Key Largo, Florida, USA (18 Feb 1973). See CONF-730231-.

The physical protection requirements that must be met by an applicant for a license to operate a nuclear reactor or fuel cycle facility are outlined. The licensed facilities would contain special nuclear material consisting of more than 5000 g of Pu, ^{233}U, or ^{235}U enriched to more than 20% in the ^{235}U isotope. (TFD)

32942 AEC INSPECTION OF MATERIALS AND PLANT PROTECTION PROGRAMS. D'Amico, V. J. (Atomic Energy Commission, Washington, DC). pp Paper 8 of Protection of Special Nuclear Materials and Facilities. New York; Atomic Industrial Forum, Inc. (1973).

From protection of special nuclear materials and facilities workshop; Key Largo, Florida, USA (18 Feb 1973). See CONF-730231-.

The procedures used by the Regulatory Operations to inspect the safeguards programs of facilities licensed to process special nuclear materials are described. (TFD)

32943 UTILITY'S APPROACH TO PHYSICAL SECURITY OF SPECIAL NUCLEAR MATERIALS. Caldwell, K. L. pp Paper 9 of Protection of Special Nuclear Materials and Facilities. New York; Atomic Industrial Forum, Inc. (1973).

From protection of special nuclear materials and facilities workshop; Key Largo, Florida, USA (18 Feb 1973). See CONF-730231-.

The physical protection system employed at the Turkey Point Nuclear Power Station for safeguarding special nuclear materials is described. (TFD)

32944 EQUIPMENT DEVELOPMENTS AND POTENTIAL APPLICATIONS. Kinderman, E. M. pp Paper 10 of Protection of Special Nuclear Materials and Facilities. New York; Atomic Industrial Forum, Inc. (1973).

From protection of special nuclear materials and facilities workshop; Key Largo, Florida, USA (18 Feb 1973). See CONF-730231-.

Some of the newer devices to detect intrusion or theft related actions are described. The use of these devices in nuclear safeguards is discussed. (TFD)

32945 LIAISON WITH LAW ENFORCEMENT AGENCIES: PLANNING AND IMPLEMENTATION. Davidson, R. H. pp Paper 11 of Protection of Special Nuclear Materials and Facilities. New York; Atomic Industrial Forum, Inc. (1973).

From protection of special nuclear materials and facilities workshop; Key Largo, Florida, USA (18 Feb 1973). See CONF-730231-.

The utilization of local, state, and federal law enforcement agencies in the planning and implementation of a physical protection system for nuclear facilities is discussed. (TFD)

32946 SAFEGUARDS AGAINST THE THEFT OR DIVERSION OF NUCLEAR MATERIALS. Nucl. Safety; 15: No. 5, 513-519 (1974).

Diversion of special nuclear material presents a threat as an explosive weapon, as a biological poison, or as a radiation source. However, there are only a few steps in the nuclear fuel cycle which are vulnerable to diversion or sabotage. These steps are identified. The protective measures required by the Commission both on site and in transit are described, as are the research and development that are under way to improve the capability of the U. S. safeguards. (auth)

32947 NONDESTRUCTIVE ASSAY OF HIGH-ENRICHMENT URANIUM FUEL PLATES BY GAMMA RAY SPECTROMETRY. Regulatory Guide 5.38. Washington, DC; Atomic Energy Commission, Directorate of Regulatory Standards (1974). 7p. (ICONS-01806).

For certain nuclear reactors, the fuel consists of highly enriched uranium fabricated into flat or bowed plates. Typically, these plates are relatively thin so that a significant percentage of the ^{235}U gamma rays penetrate the fuel cladding. When the measurement conditions are properly controlled and corrections are made for variations in the attenuation of the gamma rays, a measurement of the ^{235}U gamma rays can be used as an acceptable measurement of the distribution and the total ^{235}U content of each fuel plate. In lieu of assaying the product fuel plates, fuel plate core compacts may be assayed through the procedures detailed in this guide, provided steps are taken to ensure the traceability and integrity of encapsulation of each assayed fuel plate core compact. This guide describes features of a gamma ray spectrometry system acceptable to the Regulatory staff for nondestructive assay of high-enrichment uranium fuel plates or fuel plate core compacts. (TFD)

32948 STATISTICAL EVALUATION OF MATERIAL UNACCOUNTED FOR. Regulatory Guide 5.33. Washington, DC; Atomic Energy Commission, Directorate of Regulatory Standards (1974). 2p. (ICONS-01667).

Paragraph 70.51(e) of 10 CFR Part 70 requires certain AEC licensees authorized to possess special nuclear material to calculate material unaccounted for (MUF) quantities and their associated statistical limits of error (LEMUF) as part of their material control and accounting procedures for use in assuring that special nuclear material in their possession is accounted for. Paragraph 70.53(b)(1) requires that a report be made to the Commission if any single MUF exceeds its associated LEMUF and certain specified quantities and that the report include a statement of the probable reasons for the MUF and actions taken or planned. This guide identifies methods acceptable to the Regulatory staff for evaluating the statistical significance of observed MUF values. (auth)

Disposal and Storage

Refer also to abstracts 31687, 31693, 31695, 32007, 32020, 32022–32024, 32054, 32058, 32059, 32063, 32075, 32086, 32129, 32998, 32999, 33015, and 34471.

32949 (ARH-SA-177) SOLIDIFICATION AND STORAGE OF HANFORD'S HIGH-LEVEL RADIOACTIVE LIQUID WASTES. Schulz, W. W.; Kupfer, M. J. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Feb 1974. Contract AT(45-1)-2130. 34p. (CONF-740428-7). Dep. NTIS $4.75.

From 167th national meeting of the American Chemical Society; Los Angeles, California, USA (1 Apr 1974).

When the present Hanford Waste Management Program is completed in 1980 approximately 190 million liters of solid salt cake, produced by evaporation of aged, alkaline high-level liquid waste, will be stored in underground mild steel tanks. The current Waste Management Program also includes removal and purification of ^{90}Sr and ^{137}Cs from both stored and currently generated waste solutions. Eventually, megacuries of $^{90}SrF_2$ and $^{137}CsCl$, doubly encapsulated in appropriate metallic containers, will be stored under water. Suitability of the Waste Management Program storage procedures for safe, long-term storage of the salt cake and encapsulated $^{90}SrF_2$ and $^{137}CsCl$ has not yet been determined. Several alternative storage modes are under consideration. One of these involves engineered improvements to the underground tanks and/or fission product capsules to reduce storage risks to acceptably low values. Beyond that, the wastes could be retrieved and stored in specially constructed repositories either on- or off-site. For these latter storage modes, conversion of the solid waste to immobile silicates and aluminosilicates of low water leachability may be desirable. Laboratory-scale studies of both low- and high-temperature processes for preparation of silicate minerals and glasses are in progress; status of the work is reviewed. (auth)

32950 (CONF-740901-P2, pp 483-489) WASTE PACKAGING AND COST ANALYSIS. Webster, B. H. (Carolina Light and Power Co., Raleigh, NC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The waste processing system at Carolina Power & Light Company's H. B. Robinson Nuclear Plant is designed to package radioactive wastes in standard 30- or 55-gal drums for removal to a burial facility. The major sources of radioactive wastes are evaporator concentrates, spent resins, filters, and miscellaneous materials such as paper and rags. Estimates of volumes of solid wastes during the design of the plant included approximately 100 ft^3 of spent resins, 100 drums containing solidified evaporator bottoms and 100 drums of miscellaneous solid materials. However, during 1973 radioactive wastes from the plant included 524 ft^3 of spent resins, 750 drums of evaporator concentrates and 750 drums of miscellaneous solid materials, clearly indicating that

the volume of solid wastes was underestimated in the design of the plant. The cost of packaging and disposal of the 750 drums of evaporator concentrates was $15.82 per ft³ or a total of $88,987.50 for the year. Miscellaneous solid wastes averaged $8.33 per ft³ with an annual cost of $46,856.25. Spent resins were dewatered in a disposable liner on a truck and shipped to the burial ground. Cost for this method of resin disposal was $25.06 per ft³ for an annual cost of $13,134.00. (auth)

32951 (CONF-741018-2) PROJECTIONS OF RADIOACTIVE WASTES FROM THE NUCLEAR FUEL CYCLE. Blomeke, J. O.; Kee, C. W. (Oak Ridge National Lab., Tenn. (USA)). 1974. 8p. Dep. NTIS $4.00.

From 8th midyear topical symposium of the Health Physics Society; Knoxville, Tennessee, USA (21 Oct 1974).

Estimates of the properties and quantities of radioactive waste materials that will be generated in commercial nuclear fuel cycle operations are useful in establishing a basis for planning and development of safe and environmentally acceptable methods for management of these wastes. A comprehensive set of projections of radioactive wastes to be generated over the remainder of this century based on the most recent forecast of nuclear power growth in the United States is presented. Ten types of radioactive wastes are identified on the basis of their packaging, shipping, and probable disposal requirements, and the annual rates of generation, annual numbers of shipments, and accumulations of each type of waste are estimated. In addition, a measure of the relative toxicity of each waste on an annual and accumulated basis is tabulated. The measure of toxicity is defined as the cubic meters of air or water that would be required to dilute all the radioactive constituents of the waste to the concentrations specified in the AEC's Radiation Concentration Guide as being the maximum allowable for unrestricted use. (auth)

32952 (GSF-T-51) ON THE STABILITY OF THE SALT MINE ASSE II AS THE FINAL STORE FOR RADIOACTIVE WASTES. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Wolfenbuettel (F. R. Germany). Inst. fuer Tieflagerung). Jan 1974. 201p. (In German). INIS.

36 figs.; 15 tabs.; with refs.

The storage of radioactive wastes in salt rock masses of the deeper geological bedrock is considered as a safe procedure of sealing off such substances from the biosphere. In this report, all studies, considerations and measures taken to judge the stability of the salt mine ASSE II are summarized. The geological situation, the conditions in the cavity structure and the rock mechanics situation in the cavity structure are individually discussed. The rock mechanics factors which must be drawn upon in order to judge the stability of the cavity structure of ASSE II are discussed, in particular the bearing capacity of strongholds in the room-and-pillar systems and the estimation of available safety reserves. In situ measuring methods used to continually control the stability are also briefly described. Finally, an evaluation of the stability is made on the basis of the investigation results and observations. (GE)

32953 (KFK-1992) RADIOACTIVE WASTE MANAGEMENT POTENTIALS AND HAZARDS FROM A RISK POINT OF VIEW. McGrath, P. E. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Jun 1974. 138p. INIS.

31 figs.; 17 tabs.; 70 refs. With abstract in English and German.

The problems of radioactive waste management are discussed. The magnitude of the problem is identified as it primarily concerns the Federal Republic of Germany. Predictions are included of the characteristics of the wastes from the various activities of the nuclear fuel cycle and their accumulation as a function of time until the year 2010. All important reactor types are considered. The methods for the evaluation of risk are reviewed as well as possible extensions of the methods needed to evaluate risk from radioactive waste management strategies. For input to risk evaluation, a hazard index for radioactive isotopes is established and calculated for fuel reprocessing wastes from several reactor types. Proposed waste management strategies are reviewed and their potentials, in terms of risk reduction, are identified. An attempt is made to place the segments of the waste management strategies contributing to risk in perspective. Further effort and a refinement of the work in the area of radioactive waste management evaluation are proposed and outlined. (auth)

32954 (ORNL-TM-4639) POTENTIAL CONTAINMENT FAILURE MECHANISMS AND THEIR CONSEQUENCES AT A RADIOACTIVE WASTE REPOSITORY IN BEDDED SALT IN NEW MEXICO. Claiborne, H. C.; Gera, F. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. Contract W-7405-eng-26. 84p. Dep. NTIS $7.25.

This report examines potential containment failure mechanisms and estimates their probabilities and consequences, when possible, for a hypothetical waste repository located in bedded salt in southeastern New Mexico. The primary conclusion of this study is that a serious breach of containment for such a repository, either by human action or natural events, is only a very remote possibility and falls into the category of least likely occurrences which affect society. A sealed repository 600 m underground would be virtually sabotage proof; even the surface burst of a 50-megaton nuclear weapon could not breach the containment. Accidental drilling of boreholes through the disposal horizon could cause relatively minor local contamination. The mechanism of containment failure with the most serious potential consequences seems to be the impact of a meteorite that produces a crater extending to the disposal horizon. The probability of such a catastrophic meteorite impact was estimated at 1.6×10^{-13} per year. The calculated exposure from the global fallout resulting from such an event would be of the same order of magnitude as that from nuclear bomb tests, provided the impact did not take place during the first few hundred years after closure of the mine. The ejecta falling back into the nearby area would cause a serious and protracted contamination problem. A pathway analysis showed that individuals living exclusively on foodstuffs produced in the contaminated area would be exposed to high radiation doses. (auth)

32955 (SAND-74-0042) DEEP ROCK NUCLEAR WASTE DISPOSAL TEST: DESIGN AND OPERATION. Klett, R. D. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1974. Contract AT(29-1)-789. 130p. Dep. NTIS $4.00.

An electrically heated test of nuclear waste simulant in granitic rock was conducted to demonstrate the feasibility of the concept of deep rock nuclear waste disposal and to obtain design data. The deep rock disposal systems study and the design and operation of the first concept feasibility test is described. (auth)

32956 (WASH-1332(74)(Vol.2), pp 1041-1054) DISPOSAL OF RADIOACTIVELY ACTIVATED AND CONTAMINATED MATERIALS. Pingel, J. H.; Davis, B. J. (Atomic Energy Commission, Argonne, IL). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

It was concluded that the only sensible solution to handling radioactively activated and contaminated materials other than air and water is by producing a set of standards giving maximum permissible concentrations (MPC) of radioisotopes in such materials. Some observations relating to this conclusion are: 1. There now exists a wide variety of agencies, inconsistent with each other, dealing with such disposal. There is need for standardization. No one agency has complete jurisdiction. 2. Handling on a case-by-case basis is necessary and acceptable particularly for past commitments, but MPC type guidelines for future actions would be helpful. 3. The amount of activated or contaminated materials will increase as usage of and research in fission and fusion processes increases. 4. The setting of standards in solids (and gases and liquids other than air and water) will require a very significant effort (including some R&D) but will be an economical benefit in the long run over considering each item in the future on a case-by-case basis. Action levels are needed. 5. A public education effort of significant proportions should accompany standard setting, since the prime problem now is misunderstanding of terminology and the depth to which research effort goes in the standard setting process. 6. Emphasis should be placed on reuse and conservation of materials. 7. The long-range and overall viewpoint should be seriously considered in setting the general trend of human activities. (auth)

32957 (WASH-1332(74)(Vol.2), pp 1055-1066) HANDLING AND PACKAGING OF PLUTONIUM CONTAMINATED WASTE. Owen, J. B. (Dow Chemical U.S.A., Golden, CO). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

The Rocky Flats Plant generates significant quantities of waste materials and equipment that are contaminated with plutonium. Management systems and techniques were developed and are in use that reduce both the volume of waste generated and the quantity of plutonium involved. Containers were developed and are in use which meet the 20-year retrievability requirement of Immediate Action Directive (IAD) 0511-21. (auth)

Handling Equipment and Procedures

Refer also to abstracts 31667, 31695, 32956, and 32957.

32958 (BNWL-B-338) CRITICAL EXPERIMENTS TO MEASURE THE NEUTRON POISONING EFFECTS OF Cu AND Cu-

Cd PLATES. Bierman, S. R.; Calyton, E. D. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jan 1974. Contract AT(45-1)-1830. 21p. Dep. NTIS $4.00.

Shipping casks, storage facilities, and process vessels involved in handling fissile materials contain neutron absorbing materials—either for their neutron absorbing properties or for structural reasons. These types of systems can be fully utilized, safely, only if the neutron absorbers are properly accounted for in the criticality analyses. The reactivity worth of two such materials, copper and copper containing 1 wt % cadmium, was recently measured at the Battelle-Northwest operated Critical Mass Laboratory. The results of the measurements presented provide a set of clean, well defined, poisoned critical assemblies that can be used to check calculational techniques and cross section data. (TFD)

32959 (DP-1363) SRP HIGH-LEVEL ALPHA ANALYTICAL FACILITY. Linn, M. G.; Lilly, D. P. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Aug 1974. Contract AT(07-2)-1. 12p. Dep. NTIS $4.00.

A laboratory facility for the routine analysis of ^{238}Pu oxide was designed and built for the Works Technical Laboratories of the Savannah River Plant. The facility consists of a Dry Oxide Handling Laboratory and a Solution Analysis Laboratory separated by a Service Area. Enclosures for containing radioactive materials are interconnected stainless steel glove boxes, hoods, and radiobenches. Design criteria emphasized personnel safety, environmental protection, and operating efficiency and flexibility. Features of the facility include effective contamination control; an efficient sample entry, transfer, and exit system; corrosion resistance; automatic fire detection and suppression; and ready access to all services. The entire facility occupies a space of only 24 × 24 ft. Construction required one year and cost $250,000. (auth)

32960 NUCLEAR SAFETY PROGRAM AT DOW CHEMICAL COMPANY'S ROCKY FLATS PLANT. I. Schuske, C. L.; McCarthy, J. D. (Dow Chemical Co., Golden, CO). Nucl. Safety; 15: No. 5, 572-584(1974).

The nuclear safety program for the Dow-AEC production and research complex at Rocky Flats began in 1952. Since then, considerable changes have been made in the responsibilities of the nuclear safety and operating groups. These responsibilities include the training of personnel, the auditing of operations, and the performing of maximum-credible-accident reviews of plant facilities. Significant changes in administrative policies and documentation of these policies were brought about owing to the influence of the company management committees and the AEC's Albuquerque Operations Office. These changes are discussed. Part II, to appear in the next issue of Nuclear Safety, discusses the impact of experimental and computational programs on plant operations. (auth)

Transportation

32961 (BNWL-SA-5089) RESULTS OF STRUCTURAL ANALYSIS OF PLUTONIUM PACKAGING. Kelly, W. S.; Liu, S. N.; Creer, J. M.; DeSteese, J. G. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. 12p. (CONF-740901-16). Dep. NTIS $4.00.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

Results of a theoretical analysis of two plutonium packaging containers, the L-10 and the 6-M, are presented. The thresholds for failure under accident conditions were determined. This information will be used in conjunction with the characteristics of accidents being developed by Sandia Laboratories to provide input data to a risk analysis of shipping plutonium oxide and plutonium nitrate. (auth)

32962 (BNWL-SA-5090) IMPORTANCE OF QUALITY CONTROL IN PLUTONIUM PACKAGING LOADING. Brown, C. L.; Heaberlin, S. W. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. 17p. (CONF-740901-15). Dep. NTIS $4.00.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

The results of a study to provide the basis for estimating the probability of a closure error during the packaging of $Pu(NO_3)_4$ solution and PuO_2 powder are presented. An industry-wide survey was carried out to estimate the types and frequency of package closure errors and faults that have occurred. Included in the survey were 775 shipments involving about 6200 packages which represents most of the plutonium shipments in the past three to four years. (auth)

32963 (CONF-740901-P1) PROCEEDINGS OF THE 4TH INTERNATIONAL SYMPOSIUM ON PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIALS, MIAMI BEACH, FLORIDA, SEPTEMBER 22-27, 1974. Volume I. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). 1974. 413p. Dep. NTIS $10.60.

A separate abstract was prepared for 28 of the 31 papers included in this volume. Three papers were previously abstracted in NSA. For abstracts of these see 30: 13309, 30: 21875, and 30: 21879. (RCK)

For abstracts of individual papers see: 32964-32991.

32964 (CONF-740901-P1, pp 1-14) HARMONIZATION OF INTERNATIONAL REGULATIONS AND THE STANDARDIZATION OF TRANSPORT DOCUMENTS. Wilson, E. J.; Partridge, A. H. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The United Nations Committee of Experts on the Transport of Dangerous Goods recommends that all international and national organizations produce regulations which conform with the IAEA Regulations for the Safe Transport of Radioactive Material. International organizations have already begun work to implement this recommendation in respect of the 1973 Revised Edition of the IAEA Regulations. The paper outlines problems which have arisen in achieving harmonization. In the second part of the paper the standardization of the various documents in relation to approval and transport is discussed. Sufficient experience has now been gained to enable the actual format of competent authority certificates to be standardized. Such standardization is beneficial to consignors, carriers and other competent authorities in easing the interpretation of information and the validations of certificates originating abroad. (auth)

32965 (CONF-740901-P1, pp 15-28) UPDATE ON THE STATUS OF RECENT AND PROPOSED CHANGES TO THE U. S. REGULATIONS FOR TRANSPORT OF RADIOACTIVE MATERIAL. Grella, A. W. (Dept. of Transportation, Washington, DC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

During 1972 to 1974, extensive amendments to the U. S. Regulations for the Safe Transport of Radioactive Materials have taken or are in the process of taking place. The substance of three major rule-making dockets of the DOT Hazardous Materials Regulations Board which have been completed or are nearing completion are discussed. The major aspects of the recent revisions of the IAEA regulations as issued in its 1973 Edition of Safety Series No. 6 are also discussed. These changes are expected to be included in a major notice of proposed rule making which is expected to be issued shortly to both USDOT and USAEC regulations. (auth)

32966 (CONF-740901-P1, pp 30-40) STATE AND FEDERAL ROLES IN REGULATING THE TRANSPORTATION OF RADIOACTIVE MATERIALS. Rogers, W. M. Jr. (Western Interstate Nuclear Board, Lakewood, CO). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The current state and federal regulatory processes over shipments of radioactive materials are discussed. Principal findings and recommendations of a study of radioactive materials transportation by the Western Interstate Nuclear Board are described. The paper also stresses the need for a new atmosphere of cooperation among industry, the states, and federal government in developing a sound regulatory structure. (auth)

32967 (CONF-740901-P1, pp 41-66) STATE OF STATE REGULATIONS. Brobst, W. A. (Atomic Energy Commission, Washington, DC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Public fear of nuclear shipments often goads State regulatory agencies into action, proposing restrictive regulations on nuclear shipments, especially spent fuel and waste. Different agencies within a State have overlapping jurisdictions and regulations.

Some of the popular rules include shipment notifications and approvals, unit trains, escorts and monitors, routing and speed restrictions, limits on hours of travel, driver training, inspections, and emergency response. Similar restrictions are rarely imposed on other hazardous materials with much worse safety records. Some restrictions are counter-productive. Most are passed in haste, based on emotional reactions rather than factual studies. Rules vary between States, causing confusion and interference with free flow of commerce. Compliance is often expensive, without a commensurate gain in safety. Federal Government shipments are exempt from State regulations. The State regulations themselves are often unlawful, being prohibited in effect by the Atomic Energy Act, but they still exist, posing problems and challenges for both shipper and carrier. Recommendations are made for appropriate State action other than regulatory control of shipments: surveillance, enforcement, investigation, accident response, and participation in developing Federal regulations of AEC and DOT. (auth)

32968 (CONF-740901-P1, pp 67-77) DOT HI SYSTEM. Devine, B. D. (Dept. of Transportation, Washington, DC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The U. S. Department of Transportation has proposed a Hazard Information System which would entail the assignment of a two digit number to each package of hazardous material offered for shipment. The system will result in several changes to labeling, marking, placarding and documentation requirements for radioactive materials. Hazard Information cards, distributed to local emergency organizations, will provide advice on recommended emergency procedures. (auth)

32969 (CONF-740901-P1, pp 86-96) APPROPRIATENESS OF REGULATIONS FOR AIR SHIPMENT OF RADIOACTIVE MATERIALS. Morgan, K. Z. (Georgia Inst. of Tech., Atlanta). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The regulations for air shipment of radioactive materials are out of date and the permitted exposure levels to passengers and airline employees are much too high. The regulations are not properly enforced and the government agencies responsible for their enforcement have not adequately discharged this responsibility. (auth)

32970 (CONF-740901-P1, pp 97-98) ADEQUACY AND EFFECTIVENESS OF FEDERAL AVIATION ADMINISTRATION REGULATIONS IN CONTROLLING RADIATION DOSE TO PASSENGERS AND CREW IN PASSENGER CARRYING AIRCRAFT. Barker, R. F.; Tse, A. N.; Hopkins, D. R. (Atomic Energy Commission, Washington, DC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A program implemented to determine the radiation hazards to passengers and crew in passenger-carrying aircraft in which radioactive materials are shipped is described. Results of the investigation are not given. (TFD)

32971 (CONF-740901-P1, pp 99-104) EFFECT OF REGULATORY REVISIONS ON DESIGN AND OPERATION OF LIGHT WATER REACTORS. Gablin, K. (Protective Packaging, Inc., Tacoma). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

In order for the architects and engineers to properly design light water reactors, it is necessary to indicate trends and basic changes that make future planning as flexible as possible. The designer must understand current thinking as well as proposed revisions from Agreement States, United States Atomic Energy Commission, and United States Department of Transportation. It is the purpose of this article to point out the most significant of these changes and point out methods in which a designer can prevent his concepts from obsolescence on the drawing board. (auth)

32972 (CONF-740901-P1, pp 107-115) PROTECTION OF SPECIAL NUCLEAR MATERIAL IN TRANSIT. Powers, J. A. (Atomic Energy Commission, Washington, DC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

It is essential that the nuclear industry continue to maintain its record of never having a shipment of strategic nuclear material stolen. Regulations promulgated by the U. S. Atomic Energy Commission are directed toward requiring certain shipments of plutonium and uranium containing materials be protected against hijacking. These regulations were amended in November, 1973, and are under continuing review to assess the need for further requirements in light of the ever changing threat of hijacking. (auth)

32973 (CONF-740901-P1, pp 128-137) MANUFACTURING ENGINEERING ASPECT OF EFFECTIVE ECONOMICAL CASK DESIGN. Bush, F. J. Jr. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The contribution of the Manufacturing Engineer to effective and economical cask design for shipping of radioactive materials is highlighted. All too often the use of this discipline is not considered when engineering schedules are planned. The resultant waste of time and money are most unfortunate and should be avoided. (auth)

32974 (CONF-740901-P1, pp 138-149) DESIGN, MANUFACTURING, AND OPERATIONAL EXPERIENCE WITH THE NFS-4 SPENT FUEL SHIPPING CASK. Dufrane, K. H. (Nuclear Fuel Services, Inc., West Valley, NY). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The NFS-4 was the first spent fuel shipping cask licensed and fabricated to handle the larger physical sizes and higher fuel burnups associated with the second generation nuclear reactor plants. Its design capacity of one PWR or two BWR fuel assemblies is normally transported by truck without restriction under legal gross vehicle shipping weights. The very successful operation of the cask has been well documented by over 200 transports and typical turnaround times at reactor facilities of under four hours. The background leading to the selection of this design is discussed along with the planned development of an advanced design with double the carrying capacity. (auth)

32975 (CONF-740901-P1, pp 150-163) DESIGN AND LICENSING CONSIDERATIONS OF THE NLI 10/24 RAIL TRANSPORTATION SYSTEM FOR SHIPPING SPENT NUCLEAR FUEL. Williams, C. E.; Clarke, H. G. Jr.; Stukenbroeker, G. L. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The NLI 10/24 shielded cask and transportation system has been designed to provide the ultimate in safe shipment of irradiated nuclear fuels, a maximum payload and long equipment life. These objectives have been achieved by designing for a "zero release" system, the equipment having the capacity of 10 PWR or 24 BWR fuel elements within a 100 ton weight and with anticipated equipment life of 20 y. The design provides for a low pressure, dry shipment with double containment for radioactivity. The cask internals are an aluminum basket with each fuel assembly pocket in the basket having a liner of stainless steel clad Ag-In-Cd alloy plate. The Ag-In-Cd provides reactivity control of the system for fresh fuels in water. Lead and uranium/steel combinations are used for gamma shielding, while water is used for neutron shielding. No cooling of the cask is required for safety. However, auxiliary cooling is provided to the outer wall of the inner container by two redundant water-to-air cooling systems. The cooling systems maintain cask and fuel temperatures as low as possible solely to facilitate cask cooldown and unloading at the reprocessing plant. The cask and cooling systems are mounted on a specially designed 59 foot rail car equipped with 6-wheel trucks. The car and cargo will be within AAR Plate B dimensions for unlimited interchange. The rail car is designed and will be impact tested in accordance with AAR regulations.

Licensing of the NLI 10/24 system is anticipated in late 1974. (auth)

32976 (CONF-740901-P1, pp 164-173) GENERAL ELECTRIC RA-SERIES PACKAGE. Wilson, B. D. (General Electric Co., San Jose, CA). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Each new General Electric Boiling Water Reactor (BWR) involves the shipment and, normally, the temporary storage of up to 848 fuel assemblies for the initial core loading including spares. After nearly ten years of service, the RA-Series fuel shipping container has proved to be safe, versatile, economical and relatively simple to use. The design features of this container system and the various fuel loadings currently authorized are summarized. (auth)

32977 (CONF-740901-P1, pp 174-184) LMFBR SPENT FUEL SHIPPING CASK. Flagg, A. H. (Aerojet Mfg. Co., Fullerton, CA). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The LMFBR Spent Fuel Shipping Cask is designed to meet the transport of radioactive materials regulations and the operational requirements of the fuel handling systems of the Fast Flux Test Facility, FFTF, the Clinch River Breeder Reactor, CRBR, and an as yet undefined processing plant. The cask design is independent of developmental requirements but it does incorporate several interesting features to satisfy the regulations and service requirements. The three major subassemblies of the cask are illustrated. The shield assembly incorporates a 4.5 in. thick depleted uranium cylindrical shield within a 3 in. thick stainless steel shell with integral energy absorber structure and the carbon steel fins. The canister is a separable container which lends versatility to use of the shield assembly for other radioactive material transport. The magazine assembly is supported on bearings within the canister to allow rotation for loading through the single port in the canister head. A 12-ft FFTF fuel assembly and magazine adapter is also illustrated. A 14-ft CRBR fuel assembly would use a shorter adapter. The full length of the magazine is 15 ft, sufficient to hold an individual CRBR fuel assembly canister. (auth)

32978 (CONF-740901-P1, pp 185-196) PADUCAH TIGER: A TYPE B OVERPACK FOR TEN TON URANIUM HEXAFLUORIDE SHIPMENTS. Hansen, L. J. (Protective Packaging, Inc., Tacoma). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

In order to transport Uranium Hexafluoride (UF_6) at a ^{235}U assay greater than 1.1% within a standard 48A cylinder it became necessary to design an overpack for the cylinder that would meet the TYPE B requirements as established by AECM-0529 Packaging Standards. The package was designed, a prototype fabricated and tested in approximately eight weeks. Full scale testing included two 30 ft drops, two 40 in. puncture tests and a 1475°F exposure for 30 minutes. It successfully withstood the hypothetical accident conditions. After completion of an Engineering Evaluation Report the Paducah Tiger was issued D.O.T. Permit No. 6553. (auth)

32979 (CONF-740901-P1, pp 197-206) LLL SHIPPING CASK FOR "H" CONTAINERS. Hanson, C. (Lawrence Livermore Lab., CA); Evans, J.; Doggett, J. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Four shipping cask models of similar configuration have been designed and tested. The primary use of these overpacks is to transport large quantities of radioactive material and to provide total containment for contents during both normal transport and accident conditions. A full-size model was impact- and fire-tested to demonstrate compliance with the accident provisions of AEC Manual Chapter 0529. The casks were specifically designed for air transport and have a gross weight of approximately 4000 lbs. All models are designed for a content weight of 1000 lbs and a thermal decay of 750 W. (auth)

32980 (CONF-740901-P1, pp 207-216) DEVELOPMENT AND TESTING OF OVERPACK-CONSTRUCTIONS BASED ON PHENOLIC FOAM WALLS. Christ, R.; Schulz-Forberg, B. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The development and testing of a phenolic foam overpack for a 55 gal steel drum used for shipping liquid or solid Pu waste are described. Results of drop and fire tests on the overpacked container are presented. (TFD)

32981 (CONF-740901-P1, pp 217-231) ITALIAN TESTING STATION FOLLOWING IAEA REGULATIONS CF6: A FISSILE CLASS II TYPE B PACKAGING. Eletti, G. F.; Forasassi, G. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The facilities in Italy at the Scalbatraio Testing Center of Pisa University for testing containers for transport of radioactive materials are described. Results of the research and testing series used to finalize the design of CF6 container which is a low cost Type B, fissile class II container are reported. (TFD)

32982 (CONF-740901-P1, pp 244-260) DROP AND FIRE TESTS OF HALF-SCALE MODEL OF TN-9 SHIPPING CONTAINER. Wachtell, G. P. (Transnuclear, Inc., Falls Church, VA). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The tests were done under a contract with Transnuclear, Inc., in support of the safety analysis report of the TN-8/9 shipping container. These containers were licensed by the USAEC in May 1974. The model, supplied by Transnucleaire, S. A., Paris, France, survived the drop and fire tests without losing leak tightness of the cavity. The lead temperature remained well below its melting temperature. Computed thermal performance for both the model and full-scale shipping container showed that the lead temperature remains at least 60°F below the melting temperature. For a half-scale model of a 30-minute full-scale fire test, the heat flux should be double that of the full-scale test, and the test duration should be 7.5 minutes. The actual test duration was 10.33 minutes, to compensate for a less than doubled heat flux. For the computed model thermal performance, a doubled flux was assumed for 10.35 minutes, compensating approximately for the absence of payload self-heating in the model. (auth)

32983 (CONF-740901-P1, pp 262-276) EXPERIMENTAL STUDY ON PUNCTURE RESISTANCE OF SPENT FUEL SHIPPING CASK BY DROP IMPACT TESTS. Sakamoto, I.; Hikino, K.; Onodera, A.; Sakai, Y.; Maezawa, S. (Hitachi Shipbuilding and Engineering Co. Ltd., Osaka). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Work performed to develop the experimental equation which satisfies the criteria proposed by the Japan Atomic Energy Commission (J.A.E.C.) pertaining to the puncture resistance of the outer shell of a lead shielded cask used for shipping radioactive materials is reported. A series of puncture tests was conducted on the scale models of flat plates consisting of 3-layered members of frame work which represent the fundamental structure of prismatic cask, and also on the scale models of cylindrical casks. This series of tests provided test data on the puncture energy. Such affecting parameters as shell thickness, punch diameter, radius of punch edge etc. were determined by the non-linear regression method, and the experimental equation was obtained. The equation thus obtained was compared with those obtained elsewhere and the equation recommended by the Advisory Material for the IAEA Regulations on the Safe Transport of Radioactive Materials. It was found that the equation gives less shell thickness than that recommended by IAEA. (auth)

32984 (CONF-740901-P1, pp 277-290) INVESTIGATION OF DOT SPECIFICATION 2R CONTAINERS TO MEET SPECIAL

FORM CERTIFICATION. Andrae, R. W. (Los Alamos Scientific Lab., NM). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A test program was conducted to investigate the qualifications of 2R, pipe nipple-cap type containers as a special form encapsulation. The testing included a 30 ft drop, impact with a 3 lb weight, heating to 1475°F and quenching in water. The results indicate that the use of the 2R, pipe nipple-cap container as a special form encapsulation should probably be restricted to the shipment of solids and, then, only under the conditions that soluble solids are adequately protected by an inner container. (auth)

32985 (CONF-740901-P1, pp 306-322) ENERGY ABSORPTION CHARACTERISTICS OF STAINLESS STEEL BOLTS UNDER SHIPPING CASK IMPACT CONDITIONS. Cannon, D. D. (Oak Ridge National Lab., TN). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

An impact testing program was conducted at Oak Ridge National Laboratory to determine the energy absorption characteristics of stainless steel bolts when subjected to impact load conditions typical of those which would result from the 30-ft free drop hypothetical accident conditions for shipping casks. Stainless steel bolt specimens were impacted by dropping a free-falling weight from a fixture which transmitted a tension load to the bolt. Force-time relationships occurring during the impact event were recorded. These data were numerically converted into deformation-time and energy-time relationships. Curves of absorbed energy for various bolt geometries were prepared to illustrate their behavior. Improvements in the energy absorption capabilities by reduction in the shank diameter of the bolts were investigated resulting in the determination of an optimum ratio of shank to tensile area. (auth)

32986 (CONF-740901-P1, 323-332) CURRENT RESEARCH AND DEVELOPMENT ON SPENT FUEL SHIPPING CASKS IN JAPAN. Aoki, S. (Tokyo Inst. of Tech.). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The power reactor program in Japan and the necessity of transporting spent fuel elements are discussed. Work on the development of shipping containers is reported. (TFD)

32987 (CONF-740901-P1, pp 333-348) TRANSPORTATION RESEARCH AND DEVELOPMENT PROGRAM. Sisler, J. A. (Atomic Energy Commission, Washington, DC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The background and need for Research and Development (R&D) in the area of packaging and transportation of radioactive materials is explored. Current and future R&D programs and related data gathering functions are identified in general terms and briefly discussed. Details and current results of most of these programs can be found elsewhere in these proceedings. Starting in 1972, the AEC's Division of Waste Management and Transportation initiated a program in nuclear materials packaging and transportation R&D. Specific ongoing programs are described along with funding and manpower resources devoted to these programs. In addition, identified R&D programs of other AEC divisions are briefly described to provide a better perspective on the total AEC transport R&D. (auth)

32988 (CONF-740901-P1, pp 349-364) TRENDS AND PROJECTED SHIPMENTS IN THE NUCLEAR FUEL CYCLE INDUSTRY TO THE YEAR 2000. Salmon, R.; Blomeke, J. O.; Nichols, J. P. (Oak Ridge National Lab., TN). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Projections of the production, shipment, and accumulation of nuclear fuel, plutonium, and radioactive waste from 1974 to 2000 are presented. The nuclear power reactor complex is assumed to consist of LWRs using enriched uranium and plutonium recycle fueling, HTGRs, and LMFBRs. Installed nuclear electric capacity is taken as 102, 500, and 1200 GW(e) at the ends of calendar years 1980, 1990, and 2000, respectively, with an LMFBR capacity of 200 GW(e) at the end of year 2000. (auth)

32989 (CONF-740901-P1, pp 368-375) SPECIALIZED TRANSPORTATION FOR THE NUCLEAR AGE. Jody, B. Jr. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Specialization in the transportation of radioactive materials are discussed in respect to transport equipment, tie down systems, and driver and terminal personnel. (TFD)

32990 (CONF-740901-P1, pp 376-394) DEVELOPMENT OF HIGH STRENGTH, LOW WEIGHT, SEMI TRAILERS FOR TRANSPORTATION OF NUCLEAR FUEL. Benson, W. C. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Semi trailers for transportation of nuclear fuel casks impose new considerations on the vehicle designers. The safety standards, the need to maximize pay loads of a high value commodity, the always loaded duty cycle, the load concentration, vertical loading/unloading mode, personnel protection and air circulation are all unusual criteria to be considered in developing semi trailers. Through the development of a series of vehicles, for a variety of casks, legal and permit size, the author has accumulated experience and knowledge that is of extreme importance to anyone undertaking such a development. This paper is devoted to discussing, analyzing, and optimizing vehicle designs in this increasingly important energy industry. (auth)

32991 (CONF-740901-P1, pp 395-409) SPENT NUCLEAR FUEL SHIPMENTS BY ROTARY-WINGED AIRCRAFT. McKeown, W. L. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The economic feasibility of utilizing rotary winged aircraft for shipments of radioactive material is investigated. Inherent in this shipment method is the consideration of route control and capability to tolerate accident consequences as an alternative or companion transport safety philosophy to the present philosophy of safety accomplished through the design of shipment packaging. A case study involving shipments of spent fuel from nuclear power reactors to a fuel reprocessing plant in CY 1978 is considered, the preliminary results of which indicate that the transportation costs of this novel shipment mode are comparable to the present day costs associated with rail shipments. Advantages of this transport method related to accident likelihoods and security are presented and the reliability of a particular helicopter capable of performing this mission, the Boeing Heavy Lift Helicopter, are summarized. These preliminary results indicate a need to perform some fundamental accident consequence analysis to determine if the economic feasibility can be complemented by the required "safety" feasibility. (auth)

32992 (CONF-740901-P2) PROCEEDINGS OF THE 4TH INTERNATIONAL SYMPOSIUM ON PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIALS, MIAMI BEACH, FLORIDA, SEPTEMBER 22–27, 1974. Volume II. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). 1974. 657p. Dep. NTIS $13.60.

A separate abstract was prepared for 41 of the 51 papers included in this volume. Ten papers were previously abstracted in NSA. For abstracts of these see 30: 19462, 30: 20784, 30: 21876, 30: 21877, 30: 21880, 30: 21881, 30: 21882, 30: 21886, 30: 21887, and 30: 21888. (RCK)

For abstracts of individual papers see: 32950 and 32993–33032.

32993 (CONF-740901-P2, pp 430-437) NEW TRANSPORT TECHNIQUE FOR IRRADIATED MATERIALS. Van Impe, J.; Rombaux, J. P.; Lecerf, H.; Heylen, P. R.; Debeukelaer, R. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The use of heat transfer salts (e.g., eutectic mixtures of alkaline nitrates and nitrites of which the average melting point is 145°C) as a coolant fluid for removing decay heat from irradiated fuels during transport is discussed. (TFD)

32994 (CONF-740901-P2, pp 438-448) IMPACT PROTECTION DEVICES FOR RADIOACTIVE MATERIAL SHIPPING CONTAINERS. Lusk, E. C.; Burian, R. J. (Battelle Memorial Inst., Columbus, OH). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A program for simulating certain hypothetical accident conditions for shipping containers for packages containing radioactive materials is reported as part of a continuing testing program in progress at Battelle's Columbus Laboratories. This program is planned to collect data needed for more compact, efficient designs for impact limiters, including designs for multiple-use devices. Impact tests were performed on straight and curved fins and tube clusters. Impact tests on plywood with specific attention to grain orientation and strain rate are included in the program. Advantages and disadvantages of designs and materials (steel and wood) are discussed briefly, and it is concluded that various combinations of types of impact limiters will be required to meet the needs of the industry. (auth)

32995 (CONF-740901-P2, pp 449-462) DEVELOPMENTAL STUDY OF IMPACT LIMITERS USED FOR SPENT FUEL SHIPPING CASK. Sakamoto, I.; Yamazato, K.; Onodera, A.; Sakai, Y.; Maezawa, S. (Hitachi Shipbuilding and Engineering Co. Ltd., Osaka). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Work performed to develop impact limiters to effectively absorb the impact force to be given to the spent fuel shipping cask under the hypothetical accident conditions is reported. The methods taken in research and development of the impact limiters are: (1) taking into consideration of the phenomena that the tube element and honeycomb element for the shock absorbing materials are compressed in the confined conditions, the experimental equations on compression of the elements have been derived; (2) from the static and dynamic compression tests of these two elements, the dynamic coefficient has been obtained; the equation of motion of the shipping cask with the impact limiters during impact has been solved by the successive approximation method; and the calculation equations for deceleration and the energy absorption of impact limiters have been derived; and (3) the impact limiters for scale models of $1/4$ and $1/8$ were designed and fabricated by using the equations as derived in 1 and 2 above. These limiters were submitted to drop tests from a height of 9 m by means of the 10 ton drop test tower. Based on the results as obtained through the above-mentioned studies, the computer-aided design codes of impact limiters have been prepared. This has made it possible to design compact and high reliability impact limiters. (auth)

32996 (CONF-740901-P2, pp 463-474) RADWASTE SHIPMENTS FROM OPERATING STATIONS: AN OVERVIEW. Tuite, P. T. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

While there have been numerous shipments of radioactive waste from operating stations, data on such shipments are not readily available. This paper provides such data based on Hittman Nuclear & Development Corporation's experience with radwaste shipments. (auth)

32997 (CONF-740901-P2, pp 475-482) PACKAGING AND TRANSPORT ASPECTS OF IRRADIATED REACTOR COMPONENTS. Tarnuzzer, E. C. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Yankee Atomic Electric was faced with the problem of the disposal of a bulky, highly activated reactor component. Disassembly to fit existing casks was not entirely feasible. A DOT special permit for a large single trip container provided an expeditious and economic solution. A detailed cask description and economic comparison with a conventional licensed cask is made. (auth)

32998 (CONF-740901-P2, pp 490-503) SHIPMENT OF RADIOACTIVE WASTES FROM THE KARLSRUHE NUCLEAR RESEARCH CENTER TO THE ASSE SALT MINE. Bechthold, W. M.; Diefenbacher, W.; Schuchardt, M. C. (Karlsruhe Nuclear Research Center, Ger.). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The design of a transport containment system for the shipment of low, intermediate, and high level radioactive wastes to the Asse Salt Mine, where an extensive program for development and demonstration of methods for the safe disposal of radioactive wastes is being performed is outlined. The basic conditions of the design of the transportation system are discussed and the containment system now in use is described. (auth)

32999 (CONF-740901-P2, pp 504-516) COST-BENEFIT ANALYSIS OF DISPOSABLE AND REUSABLE RADWASTE SHIPPING CONTAINERS. Coplan, B. V.; Mayo, P. J.; Rutland, L. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A cost benefit comparison was made between disposable and reusable shipping container concepts for handling radwaste from nuclear power generating plants. For this study, reinforced concrete containers were used to typify the disposable container concept, and thin shell steel containers with lead and steel auxiliary shields were used to typify the reusable container scheme. Concrete containers were found for this example to be economically competitive and could represent a significant savings in overall waste disposal costs. Other equally significant advantages which may also result from the use of disposable concrete containers include reduced shield inventories, maintenance, or rental costs for the utility; fewer scheduling problems associated with availability of shielding for radwaste transportation; more convenient and safer handling at the power station and the burial site; potential long-term durability and ease of retrievability at the burial site. The results of this study suggest that concrete radwaste disposal containers should be seriously considered for central nuclear power station use and that more detailed design studies, economic evaluations for specific power plants, and regulatory concurrences should be pursued. (auth)

33000 (CONF-740901-P2, pp 517-538) DEVELOPMENT OF STANDARDS ON THE PACKAGING AND TRANSPORTATION OF FISSILE AND RADIOACTIVE MATERIALS. Spiegelman, A. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The organization and work of the N-14 Committee for the development of standards on packaging and transportation of fissile and radioactive materials are described. The four standards developed by the Committee are discussed along with additional standards that are being developed. Past transportation accidents involving radioactive materials are listed. (TFD)

33001 (CONF-740901-P2, pp 539-546) QUALITY ASSURANCE PROGRAM FOR FISSILE MATERIAL PACKAGING. Adcock, F. E. (Dow Chemical Co., Golden, CO). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Rocky Flats Division of Dow Chemical USA has a simple program for assuring quality at all phases of container construction and use. The program is applicable to containers for fissile material and to other radioactive material containers where cooling and shielding are not necessary. The key to the program is a set of engineering drawings which include inspection forms that designate acceptance criteria, inspection and maintenance requirements, and serve as permanent records. (auth)

33002 (CONF-740901-P2, pp 566-586) RADIATION LEAKAGE FROM NARROW GAPS IN SHIELDS. Haworth, R.; Liquorish, R. A. C.; Taylor, C. B. G. (Radiochemical Centre Ltd., Amersham, Eng.). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Clearance gaps around plugs and other movable components can

be a significant source of radiation leakage from large casks. There is, however, a lack of quantitative information on which a designer can base his choice of clearance dimension. The factors underlying this problem are discussed, and expressions based on a single-scatter approximation are derived for some typical geometries. Calculated data is presented for iron, lead and uranium shields, for ^{60}Co and ^{137}Cs gamma radiation. Experiments to check the expressions are described. It is shown that the accuracy of this method is sufficient for dealing with practical problems. (auth)

33003 (CONF-740901-P2, pp 587-596) GAMMA RAY SHIELDING EFFECT OF A LEAD SHIELDING FOR RADIOACTIVE MATERIAL SHIPPING CASK AND ITS INTEGRITY INSPECTION METHOD. Ueki, K. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A nondestructive inspection technique using radioisotopes to detect shielding deficiencies with a high accuracy is described. It was found that for calculation of radiation dose rates around a cask one should take account of the influence of the distance between the cask and detector on buildup factor. In the nondestructive method it is possible to detect a deficiency of 1 mm thick in cylindrical lead shields of 10 cm thick. A ^{60}Co, 6 μCi gamma ray source is sufficient for detection. The detector is a NaI(Tl) scintillation spectrometer surrounded with a lead shield. The pulse-height distributions obtained by the detector are converted into energy spectra by the response function for the NaI crystal. Energy spectra of 10, 10.1, 10.2, 10.3 and 10.4 cm thick of lead cylinders are shown in graphic form. Energy buildup factors are calculated to estimate gamma ray shielding effect of lead cylinders, up to 20 cm thick, by a CASK-GM Monte Carlo code using an importance sampling technique. The buildup factors show a marked dependency on the distance from the surface. (auth)

33004 (CONF-740901-P2, pp 597-607) STANDARD FOR LEAKAGE TESTS ON PACKAGES FOR SHIPMENT OF RADIOACTIVE MATERIALS. Taylor, W. R. (Chalk River Nuclear Labs., Ont.). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Subcommittee N14.5 of the American National Standards Institute has formulated a standard for leakage tests for packages which contain Type B quantities of radioactive materials. The standard specifies methods for demonstrating that Type B(U) and Type B(M) packages comply with the package containment requirements specified in the International Atomic Energy Agency "Regulations for the Safe Transport of Radioactive Materials", 1973 edition. IAEA containment requirements are expressed in terms of curies per unit time and basically, the standard relates practical leakage tests, expressed in terms of engineering leakage rates, to these requirements. The standard includes appendices which contain very useful information on the "How to apply" aspects of leakage testing. As the subcommittee formulated the standard it became evident that the appendices should be augmented and made even more useful. Information such as other leakage test procedures, other assessment techniques or descriptions of proven containment and closure components is required. The purpose of this paper is: (a) to describe the present standard, and (b) to stimulate discussion and feedback information for inclusion into the standard. This paper describes the formulation, content and application of the standard. It lists limitations and difficulties in relating leakage tests to package containment requirements. It identifies what information is required to augment the standard and it suggests areas of clarification of regulatory containment. (auth)

33005 (CONF-740901-P2, pp 608-610) NUCLEAR CRITICALITY SAFETY AND TRANSPORT CONTAINER UTILITY. Thomas, J. T. (Oak Ridge National Lab., TN). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A brief description of the proposed American National Standards Institute standard "Guide for Nuclear Criticality Safety in the Storage of Fissile Materials" is given. The use of the guide to establish allowable mass loadings in shipping containers is discussed. (TFD)

33006 (CONF-740901-P2, pp 611-614) NEW METHOD FOR LICENSE CONTROLS ON NUCLEAR FUEL PACKAGES. Wilson, B. D. (General Electric Co., San Jose, CA). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Currently, license authorizations for fuel packages limit the contents, generally on the basis of mass or enrichment, or both, as well as chemical and physical form of the fuel. This paper discusses considerations of an alternate method whereby the k-infinite value of a "model fuel" is specified as a license condition (rather than mass or enrichment), and the licensee is required to determine that the k-infinite value of each specific fuel of similar design to be shipped in the container is not greater than that of the "model" fuel. (auth)

33007 (CONF-740901-P2, pp 616-633) CRITICALITY CALCULATION METHOD FOR MULTI-ELEMENT LWR FUEL SHIPPING PACKAGES. Odegaarden, R. H.; Marotta, C. R. (Atomic Energy Commission, Washington, DC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The methods used by the AEC Regulatory Staff to determine the subcriticality of multi-element LWR fuel shipping packages are described. An arbitrary four element cask design is used as a basis for the discussion. The paper explains the assumptions which are made in determining the geometric model, atom densities and neutron cross sections used in the calculations. (auth)

33008 (CONF-740901-P2, pp 634-646) IMPROVEMENTS IN THE FIELD OF THERMAL TRANSFER TO TYPE B PACKAGINGS FOR TRANSPORTATION OF IRRADIATED FUEL ELEMENTS WITH RESIDUAL POWER. Bochard, C. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The increase in power of irradiated fuel element packages, the new prescription of the IAEA safety regulations which requires taking into consideration the heat transfer by convection during the thermal test, the neutron shieldings which, generally, do not bear high temperatures make more difficult the problem of the thermal protection of the packagings. A technique developed in cooperation with the French Atomic Energy Commission is presented that can solve these problems with all the required safety guarantees. (auth)

33009 (CONF-740901-P2, pp 647-655) STUDY ON FIRE RESISTIVITY FOR SPENT FUEL SHIPPING CASK. Shimada, H.; Moriya, T. (Fire Research Inst. of Japan, Tokyo). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The object of this study was to assess the fire resistivity of spent fuel casks. Heat durability experiments were made in a furnace for a few cask models whose shells were lined with lead homogeneously before casting lead for better contact between the shell and the lead shield. It was found from the analog computer analysis of the experimental results that a lead-lining treatment of the cask shells served to raise the thermal conductance between the shells and the lead 10 times to 1800 kcal/m^{2}h°C from 180 kcal/m^{2}h°C of the thermal conductance for the untreated one. As for the full-scale casks, this thermal conductance needs to be less than 220 kcal/m^{2}h°C to protect the fuel from fire. It cannot be said that casks with no gap between the shell and the lead shield will not keep their integrity against the standard fire (800°C, 30 min). (auth)

33010 (CONF-740901-P2, pp 656-658) CAPABILITIES AND LIMITATIONS OF HEAT PIPES FOR USE IN RADIOACTIVE MATERIAL SHIPPING CASKS. Lewis, M. (McDonnell Douglas Astronautics Co., Richland, WA). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The merits of using heat pipes to remove decay heat from spent fuel shipping casks are discussed. A design concept for a heat pipe-cooled cask is presented. (TFD)

33011 (CONF-740901-P2, pp 659-667) FURNACE TEST BY THE STANDARD FIRE CURVE AS AN ALTERNATE METHOD TO MEET THE THERMAL TEST REQUIREMENTS. Schulz-Forberg, B. (Bundesanstalt fuer Materialpruefung, Berlin). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The IAEA-Regulations, 1973 edition, gives the general requirements of the thermal test as in the 1967 edition. In an Advisory Material common test procedures are found, e.g., one fuel oil fire and two different furnace tests. In relation to the general requirements and the open fire, in former times defined in the IAEA-Regulations themselves, the furnace test using the standard fire curve is explained. Thermal stresses in the outer shells of packagings are mentioned. (auth)

33012 (CONF-740901-P2, pp 702-717) DESIGN FOR A CASK COOLDOWN SYSTEM. Hager, E. R. (Allied-General Nuclear Services, Barnwell, SC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The described system is intended to cool spent fuel shipping casks to temperatures which will not cause boiling when inserted into the reprocessor's storage pool at the Barnwell Nuclear Fuel Plant (BNFP). Cask temperatures will be reduced in this closed cycle system utilizing three phases beginning with a pressurized hot water feed. This feed is vaporized and then condensed and recycled until the cask is filled. The cask is allowed to boil under reduced pressure in the second phase, and is kept filled with the condensate. The final phase consists of recirculating water through the cask and a water to water heat exchanger to reduce temperatures below boiling. A filter and deionizer are used to limit system activity. A comprehensive test program is planned for the cask and cooldown system. (auth)

33013 (CONF-740901-P2, pp 718-729) SMOKELESS GASOLINE FIRE TEST. Williams, H.; Griffin, J. F. (Mound Lab., Miamisburg, OH). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

As a result of the recent concern by environmentalists, the hypothetical accident thermal test can no longer be performed by simply burning gasoline in an open pit. The uncontrolled open pit technique creates thick, dense, black clouds of smoke which are not permitted by local authorities. This paper deals with the design of the fire test facility and the techniques used to eliminate the smoke plume. The techniques include the addition of excess air to the fire in combination with a spray of water mist near the fuel surface. The excess air technique has been used successfully in an experimental setup; it was found that the temperature could be controlled in the neighborhood of the required 1475°F environment and the smoke could be reduced to very low levels. The water spray technique has been successfully used by others in similar applications and, on completion of a permanent fire test facility at Mound Laboratory (anticipated July, 1974), test results will be available. The water is believed to interact with the combustion reaction to provide more complete combustion. The permanent facility will be a 10 × 10 ft cement block enclosure lined with firebrick. It will be 8 ft high on three sides and 4 ft high on one side to provide for observation of the test. A 5000-gal underground tank provides storage for the aviation gasoline which is gravity fed to the fire. (auth)

33014 (CONF-740901-P2, pp 730-742) EVALUATION OF RISK MODELS FOR RADIOACTIVE MATERIAL SHIPMENTS. Russell, J. L. (Environmental Protection Agency, Washington, DC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The risk determination for radioactive materials shipments considers both the probability of an accident event leading to a release of radioactivity and the consequences resulting from that release. The probability is dependent on three parameters; the probability of a vehicle accident, the probability of cask failure and the radionuclides release fraction. Three inputs are also required to determine the consequences of an accident; environmental transport, dose conversion factors and population density and distribution. Only two of the estimates for the six inputs have reasonably small ranges; the probability of transport vehicle accident and the dose conversion factors. It is possible to provide a reasonable assessment of the consequences even with the large ranges of estimates for environmental transport and population density. However, no assessment of the probabilities of an accident involving a release can be made with any assurance because of large uncertainties in cask failure probabilities and specific release fractions. On the basis of this review suggestions are given as to where further evaluatory efforts should be made. (auth)

33015 (CONF-740901-P2, pp 785-797) IMPACT OF THE PROPOSED DISPOSAL OF HIGH-LEVEL RADIOACTIVE WASTE AT THE NEVADA TEST SITE ON THE TRANSPORTATION OF REACTOR WASTE PRODUCTS. Carter, M. W.; Moghissi, A. A. (Georgia Inst. of Tech., Atlanta). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A recent concept proposes the conversion of high-level radioactive waste to glass and its disposal at the Nevada Test Site (NTS). Application of this concept has a certain impact on the packaging and transportation of the high-level waste. Identification of the chemical and physical status and the disposal site simplifies packaging and transportation of high-level waste. It is shown that railroad routes from present and projected fuel reprocessing plants to the NTS are either available or the missing untracted distance is small. The proposed storage sites are compared with the NTS in terms of differences of transportation distances and certain other criteria. (auth)

33016 (CONF-740901-P2, pp 798-813) SPENT FUEL TRANSPORTATION ON HIGHWAYS: THE RADIOACTIVE DOSE TO THE TRAFFIC. Yadigaroglu, G. (Univ. of California, Berkeley). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The radioactive exposure of the traffic moving on the same highway as spent fuel shipments has been neglected in the past. This paper presents methods for calculating peak exposures, the number of individuals receiving a dose in excess of a certain limiting value, and the cumulative population doses for the occupants of the vehicles. Estimates of these three quantities are given for a variety of highway and accident conditions and are compared to the corresponding stationary-population doses. Both routine direct-radiation exposures and accidental releases are considered. It is concluded that the traffic doses can be of equal or greater importance than the stationary-population doses. (auth)

33017 (CONF-740901-P2, pp 814-829) RISK ANALYSIS OF SHIPMENTS IN THE NUCLEAR POWER INDUSTRY. Hodge, C. V. (Holmes and Narver, Inc., Anaheim, CA); Baldonado, O. C. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A study was undertaken to determine risks from the transportation of radioactive materials generated in the production of electricity in the United States for the period 1970 to 2020. Radiation exposures under conditions of both routine transport and transport accidents were considered. Movements of spent fuel, recycled plutonium, and high level radioactive solidified waste were studied. The calculated gamma dose to the growing population from all routine shipments of these materials was found to not exceed 50 person-rems/yr by 2020. In the study of shipments of radioactive material meeting with accidents, the probabilities with which different barriers in a spent fuel shipping cask are breached by the physical forces associated with accidents were used in fault tree analysis to determine the release probability values for the cask under varying conditions of accident severity and release severity. The results range from about 1E-5 for puff releases in minor accidents to about 1E-2 for small leaks in moderate or severe accidents. An upper limit for the probable annual national accident dose, assuming that the entire content of the cask is released in the form of 0.5 MeV gamma radiation, using these release probability values, was found to not exceed 300 person-rems/yr by 2020. (auth)

33018 (CONF-740901-P2, pp 830-847) POSSIBILITY OF RELEASE OF CESIUM IN A SPENT-FUEL TRANSPORTATION ACCIDENT. Ross, M. (Univ. of Michigan, Ann Arbor). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The hazards associated with the release of cesium in a hypothetical event in the transportation of spent reactor fuels are considered. The release of Cs present a very grave problem, much more important than the release of krypton and iodine considered in previous studies. An accident in the transportation of light water reactor fuels to the reprocessing plant is assumed which results in loss of the cooling water from a cask. The loss of coolant will also lead to escape of some volatile and soluble fission products. The Cs migrates in the fuel pellet during irradiation and substantial quantities escape and are deposited on the cladding. Furthermore, the cladding of the fuel pins in the postulated accident would experience much higher temperatures than in normal reactor operation. An estimate of the amount of release of Cs from the fuel, from the fuel pin, and from the cask into the atmosphere is made. The exposure to which a population might be subject at a distance from the cask is considered. The isotopes involved, ^{134}Cs and ^{137}Cs, are among the most potent known. The ensuing somatic effects and implied effects on land use are briefly discussed. (auth)

33019 (CONF-740901-P2, pp 848-853) ENVIRONMENTALIST'S ROLE IN THE HANDLING OF RADIOACTIVE MATERIALS. Mustard, J. K. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The author's position is that an electrical power system based on nuclear fission and the resulting radioactivity is too dangerous to allow. It is his opinion that once the public is educated on atomic energy they will reject the process rather than accept it. (TFD)

33020 (CONF-740901-P2, pp 854-863) SAFE TRANSPORTATION OF PLUTONIUM LIQUID OR SOLID PRODUCT? Sousselier, Y.; Redon, A. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

At the Third International Symposium on Packaging and Transportation of radioactive materials, several papers introduced the discussion on the evaluation of product form in safety of plutonium transportation. Since this date some tendancy appears in favor of transporting plutonium in solid form only. Is such a tendancy fully justified in the frame of the 1973 revised Regulations for the safe transportation of radioactive materials (IAEA Safety Series n0.6). An attempt is made to study this problem in terms of several factors. (auth)

33021 (CONF-740901-P2, pp 873-882) DEVELOPMENT, DESIGN, AND EVALUATION OF A PACKAGING FOR THE TRANSPORTATION OF PLUTONIUM. Best, R. E. (Allied-General Nuclear Services, Barnwell, SC); Ridihalgh, J. L. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

In 1972, Allied-General Nuclear Services and Battelle-Columbus Laboratories embarked on a program to develop a 100-liter plutonium nitrate packaging. Existing L-10 packagings were determined to be inadequate for transporting the Barnwell Nuclear Fuels Plant's recovered plutonium product. The 100-liter program was deferred in favor of an oxide packaging program in early 1973. An SAR for the oxide packaging will be submitted to the AEC in late 1974. This oxide packaging will approximate the L-10 in outside dimensional envelope, provide redundant (double) confinement for the oxide power, and contain 25 kilograms of plutonium in oxide form. (auth)

33022 (CONF-740901-P2, pp 897-904) DOT-APPROVED PACKAGING FOR SHIPMENT OF GRAM QUANTITIES OF PLUTONIUM AS THE NITRATE SOLUTION. Lund, D. M.; Yamamura, S. S. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

An approved container suitable for domestic and overseas shipment of up to 5 g of plutonium as the nitrate solution was required to implement the Safeguards Analytical Laboratory Evaluation (SALE) Program. The shipping container approved by the Department of Transportation for this particular use was a standard DOT Specification 6M Type B, 15-gal steel drum, modified to ensure retention of the lid and release of internal pressure in event of accident or exposure to fire. The total containment, inner containment plus outer shipping container, is such that loss of plutonium and resultant spread of radiation or contamination is very unlikely in the event of accident during shipment. Details of the inner containment and the modifications of the shipping container are described. (auth)

33023 (CONF-740901-P2, pp 905-928) DESIGN AND TESTING OF THE SL-10-1 SHIELDED PLUTONIUM NITRATE SHIPPING CONTAINER. Householder, W. R.; Greer, N. L. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Due to the advent of plutonium to be derived from reactor fuel which has undergone burn-up on the order of 40,000 MWd/MT there is a need for a shielded plutonium nitrate shipping container with increased decay heat dissipation capabilities. Existing containers, notably the L-10 and FL-10-1 containers, can only dissipate 10 or 20 watts, respectively, and provide very limited gamma and neutron shielding. This paper describes the design and testing of a shielded plutonium nitrate shipping container designated the SL-10-1, which will dissipate 35 watts of decay heat under normal and accident conditions as defined by USAEC regulations. Gamma shielding in the SL-10-1 is provided by $\frac{1}{16}$ in. steel, $\frac{1}{4}$ in. stainless steel and $\frac{1}{2}$ in. lead; the neutron shield is $7\frac{1}{2}$ in. thick WEP which affords neutron shielding equivalent to 3 in. water containing 1 w/o boron. WEP is Ashland Chemical Company's water extended polyester. The SL-10-1 was tested by performing a puncture test, two 30-ft drop tests and a one-hour diesel oil fire test in addition to 31 days of decay heat testing. The container satisfactorily passed all testing, and its decay heat dissipation capability was satisfactorily demonstrated. (auth)

33024 (CONF-740901-P2, pp 930-942) SRL 4.5-TON CALIFORNIUM SHIPPING CASK. Walsh, J. P.; Mahoney, D. J. (Savannah River Lab., Aiken, SC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A shipping cask to contain californium neutron sources has been in service for more than two years. The cask, designed especially for ^{252}Cf sources fabricated at the Savannah River Laboratory for commercial and institutional participants in an AEC evaluation program, meets both AEC and IAEA criteria for shipping Type B quantities of radioactive materials. The cask is 5-ft-dia mild steel sphere with a central cavity for secondary containers holding the primary source capsules. The annular space between the outer steel sphere and the stainless steel central cavity is filled with a cast-in-place matrix of water-extended polyester (WEP). The cask has been used for a number of domestic shipments and one foreign shipment and is easily handled by an overhead crane or a forklift vehicle. Pertinent information concerning materials of construction, fabrication, and testing is available for review by prospective users. (auth)

33025 (CONF-740901-P2, pp 943-964) CALIFORNIUM-252 PACKAGING AND TRANSPORT. Moyer, R. A.; Boulogne, A. R. (Savannah River Lab., Aiken, SC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Californium-252 is packaged at the Savannah River Laboratory for use in medicine, industry, and research. Encapsulation techniques were developed within the framework of "Special Form" packaging regulations so that line and point sources could be supplied for the U. S. Atomic Energy Commission's market evaluation program and for "bulk" sales to commercial encapsulators of radioisotopes. "Special Form" capsule testing techniques and quality assurance procedures for source and package fabrication are described. Various designs of medical and industrial sources and sales packages are shown and discussed. Several casks for domestic and international shipments were designed and built at the Savannah River Laboratory during the past six years. Four of these casks are briefly described. (auth)

33026 (CONF-740901-P2, pp 972-987) SURVEY OF PROBLEMS ENCOUNTERED IN ITALY WITH IRRADIATED FUEL TRANSPORTS. Cuttica, G.; Cane, G. (ENEL, Rome). 1974.

From 4th international symposium on packaging and transporta-

tion of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Since the advent of commercial power in Italy in 1963, numerous shipments of irradiated fuel to the reprocessing plants have been effected by land and sea. All the transports were arranged jointly by ENEL and the reprocessors. Although the safety record of these transports has been quite high, a few mechanical problems were experienced with the means of conveyance. These problems are discussed, together with the weights and activity levels involved and the lessons learned therefrom. The paper then describes some of the major difficulties encountered by the station staff, mainly in connection with the characteristics of the flasks (shielding, activity release and external contamination) and the makeshift arrangements made to overcome them and to carry out the transports in compliance with the existing regulations. Since the same problems, but on a larger scale, are envisaged with the flasks to be utilized for transport of the irradiated fuel discharged from second-generation reactors and even from first-generation reactors using recycled plutonium, suggestions based on operating experience are made for possible remedies and, when first-hand experience is lacking, the problems are outlined as a reminder to the designers of irradiated fuel shipping flasks. (auth)

33027 (CONF-740901-P2, pp 988-994) TRANSPORTATION OF SPENT FUELS. Turner, L. L. (Savannah River Operations Office, Aiken, SC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

This paper deals with transportation as a function of movement from point to point and intentionally omits the functions of container selection, packaging, decontamination, surveying, and package labeling as belonging to other expertises within the total system. It discusses the siting of facilities, transportation charges, carrier modes, carrier equipment, loading, vehicle placarding, routing and tracing, bills of lading, state regulations, shipper-receiver liaison, unloading, vehicle surveys and release. (auth)

33028 (CONF-740901-P2, pp 995-1013) MILITARY EXPERIENCE WITH PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIALS. Edgerton, J. H. (Army Transportation Engineering Agency, Newport News, VA). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Military experience with packaging and transportation of radioactive materials involves the use and movement of all types of radioactive materials including radioisotopes, large sources, nuclear fuel, spent nuclear fuel elements, irradiated and contaminated reactor systems and components, and radioactive waste. To identify transportation environmental effects, the Military Traffic Management and Terminal Service Transportation Engineering Agency (MTMTSTEA) has monitored shipments of various radioactive reactor systems and components, spent nuclear fuel, and spent control rod casks. The US Army PM-2A nuclear power plant reactor systems and components and spent nuclear fuel shipments were monitored from Thule, Greenland, to the Continental United States. A movement by highway of a 15-ton spent fuel element cask was monitored for shock and vibration from Wilmington, Delaware, to Alberquerque, New Mexico. A spent control rod shipping cask from the US Army MH-1A Sturgis floating nuclear power plant was monitored for shock, vibration, temperature, and humidity effects resulting from transport from Gatun Lake, Panama Canal Zone, to Battelle Memorial Institute, West Jefferson, Ohio. These monitorings have provided significant data to resolve transportation problems encountered during the dismantling, decontamination, and decommissioning of reactor facilities. MTMTSTEA develops transportability criteria and provides guidance to aid shippers of military radioactive materials. However, there are areas requiring additional research, as pointed up in this report. (auth)

33029 (CONF-740901-P2, pp 1014-1019) RADIOACTIVE CONTAMINATION ON TRANSPORT VEHICLES. Loud, G. C. 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Since July, 1972 the Nuclear Transportation Division of Tri-State Motor Transit Co. has performed routine radiation and radioactive contamination surveys of Tri-State terminals and transport vehicles. Through May, 1974, the program included 62 surveys of 20 terminals, and surveys of 127 power units and 1,640 trailers. Radioactive contamination was detected at 5 terminals and on 4 power units and 48 trailers. Contamination at terminals ranged from a single radioactive particle on the shop floor to 14 M^2 of yard contaminated to 2,500 counts per minute beta-gamma. The latter occurred where a spent fuel cask had been parked during a rainstorm. Radiation in excess of the 0.5 millirem per hour allowed by Department of Transportation regulations was detected on 3 power units and 16 trailers. One trailer, in addition, had more than 400 times the smearable beta contamination allowed by the regulations. Alpha contamination was detected on the right front tire of one tractor and in a small area on the floor of one trailer. The record indicates a potential for serious loss of control of radioactive contamination, particularly during maintenance of transport vehicles. Routine work at every terminal includes sweeping trailer floors to remove debris which accumulates during loading and unloading. Many terminals are equipped to repack wheel bearings, replace brake linings and perform minor maintenance. Major maintenance terminals, in addition, replace floors and sandblast trailers to prepare the metal surfaces for repainting. All these activities have the potential for spreading radioactive contamination to shops and shop personnel. The growth of nuclear transportation makes it urgent that the industry review transport vehicle and container release limits and methods, and change them as necessary to maintain control of radioactive contamination. (auth)

33030 (CONF-740901-P2, pp 1020-1026) RECEIPT OF IRRADIATED FUEL SHIPMENTS AT THE ICPP-NRTS. Morrow, L. F.; Nichols, C. E. (Allied Chemical Corp., Idaho Falls, ID). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The Idaho Chemical Processing Plant receives irradiated fuel shipments from several countries as well as numerous reactor facilities throughout the United States. The fuel is received by Operations and surveyed by Health Physics for compliance with DOT regulations prior to official acceptance of the shipment for unloading and storing. The unloading techniques for various fuel types received at ICPP for both underwater and dry storage are described. Fuel receiving problems are discussed concerning radioactive contamination, completeness of shipping information and the problems encountered when two or more shipping containers arrive on the same shipment and are addressed to different AEC installations. Fuel shipments arriving at the ICPP are first subjected to sampling prior to unloading. Gas or water samples, depending on the environment within the fuel shipping container, are withdrawn and analyzed to detect the presence of radioactive fission products. These samples are necessary to insure the integrity of the fuel cladding. Detection of fission products could indicate fuel element leakage in which case the fuel shipping container would be returned to the shipper for canning of the damaged element. Current policy requires an ICPP observer to be present during the canning of any fuel to be sent to the Idaho Chemical Processing Plant for storage and reprocessing. Previous experience with inadequately canned elements and our current canning procedural requirements are outlined. Insufficient information accompanying a nuclear fuel shipment can create receiving and storage problems. Nuclear safety might be compromised as well as confusion regarding the proper unloading destination. Suggestions are made to minimize these problems. Preparation of containers for shipping is reviewed concerning decontamination problems, turnaround time, and the apparent leaching of radioactive contamination during transport. A summary is made of DOT violations encountered to date. (auth)

33031 (CONF-740901-P2, pp 1027-1040) RECOVERY AND RETURN TO SERVICE AFTER A TRANSPORT ACCIDENT OF THE SPENT-FUEL SHIPPING PACKAGE FOR THE PEACH BOTTOM ATOMIC POWER STATION. Chandler, J. M. (Oak Ridge National Lab., TN). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The recovery of the loaded Peach Bottom single-element shipping package involved in a highway accident in which the transport vehicle was wrecked is described. It describes action taken to retrieve the shipping package from a roadside ditch and to complete the delivery of the undamaged fuel element to its destination at Oak Ridge National Laboratory. There the staff made a detailed

inspection of the shipping package and its cradle-support structure, corrected minor damage to the support ring, and refurbished the shipping package for prompt reuse. (auth)

33032 (CONF-740901-P2, pp 1041-1050) SEVERE RAILWAY-ACCIDENT WITH UF_6 PACKAGINGS. Schulz-Forberg, B. (Bundesanstalt fuer Materialpruefung, Berlin). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A severe railway-accident happened in the Federal Republic of Germany in November 1970. Two UF_6 packages were variably damaged by falling off a car with a speed of 100 km/h (65 mph). After descriptions of the accident and damages, the additional risk of a fire from such an accident is discussed. (auth)

33033 (CONF-740901-P3) PROCEEDINGS OF THE 4TH INTERNATIONAL SYMPOSIUM ON PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIALS, MIAMI BEACH, FLORIDA, SEPTEMBER 22–27, 1974. Volume III. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). 1974. 153p. Dep. NTIS $7.60.

A separate abstract was prepared for 9 of the 10 papers included in this volume. One paper was previously abstracted in NSA. For an abstract of this paper see CONF-740901-16. (RCK)

For abstracts of individual papers see: 33034–33042.

33034 (CONF-740901-P3, pp 1051-1058) RADIOACTIVE MATERIAL PACKAGE DESIGN REVIEWS. MacDonald, C. E. (Atomic Energy Commission, Washington, DC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The review and licensing in the U. S. of package designs used for the transport of radioactive materials is discussed. The responsibilities of the DOT and the AEC, the preparation of an application and the methods used to verify an applicant's findings are discussed. The scheduling of the licensing process is also discussed. (auth)

33035 (CONF-740901-P3, pp 1067-1069) PANEL DISCUSSION ON "NUCLEAR CRITICALITY SAFETY". Shultz, K. R. (Atomic Energy Control Board, Ottawa). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The Canadian regulations for the safe transport of fissile materials and the choice of a model to analyze criticality are briefly described. (TFD)

33036 (CONF-740901-P3, pp 1071-1084) CAPABILITIES AND LIMITATIONS OF HEAT PIPES FOR USE IN RADIOACTIVE MATERIALS SHIPPING CASKS AS AN ALTERNATIVE TO ACTIVE COOLING SYSTEMS. Lake, W. H. Jr. (Atomic Energy Commission, Washington, DC). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A discussion of thermal design of shipping casks for radioactive materials is presented. Consideration is given to active auxiliary cooling systems, which are found to be less desirable than passive cooling systems. It is recognized, however, that in some instances auxiliary cooling of the shipping cask may be necessary. The use of the heat pipe, a passive heat transfer device, is noted as a potential for this application. The principles of operation of the heat pipe and some of its design parameters are discussed. Both the advantages and disadvantages of heat pipe systems are examined with respect to shipping cask requirements. (auth)

33037 (CONF-740901-P3, pp 1085-1097) HEAT TRANSFER CORRELATION FOR FINNED CASKS. Griffin, J. F. (Mound Lab., Miamisburg, OH). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Design of finned casks for dissipation of heat from radioactive decay usually requires reliance on generalized correlations in the literature which do not necessarily apply to the specific cask design. A correlation was developed, based on temperature profile measurements, for the design of upright cylindrical casks with vertical fins for convective and radiant heat transfer to ambient air. Temperature data at various heat loads were obtained for two different cask sizes of the same basic design. Each cask is mounted on a steel pallet and contained within a steel mesh cage. The smaller cask, which has 23 fins, has been approved (DOT-SP-6321) for shipment of up to 1400 W(th), and approval is being obtained (AEC AL USA/9503 BLF) for shipment of up to 3500 W heat load in the larger, 60-fin cask. The applicable theoretical equations were fit to the temperature data for both casks by simply adjusting the value used for the number of fins. The resulting correlation provides a reliable method for interpolation and extrapolation and for design of similar finned casks. (auth)

33038 (CONF-740901-P3, pp 1100-1117) RISK ASSESSMENT MODEL FOR RADIOACTIVE MATERIAL SHIPMENTS. McSweeney, T. I.; Williams, L. D.; Watson, E. C.; Droppo, J. G.; Kottwitz, D. A.; Hall, R. J. (Battelle Pacific Northwest Labs., Richland, WA). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A method for assessing the risk of radioactive material shipments is given. The type of information required to perform the assessment is described. (auth)

33039 (CONF-740901-P3, pp 1130-1147) IMPORTANCE OF QUALITY CONTROL IN PLUTONIUM PACKAGING LOADING. Brown, C. L.; Heaberlin, S. W. (Battelle Pacific Northwest Labs., Richland, WA). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

Results of a study to provide the basis for estimating the probability of a closure error during the packaging of $Pu(NO_3)_4$ solution and PuO_2 powder are presented. An industry-wide survey has been carried out to estimate the types and frequency of package closure errors and faults that have occurred. The survey covered 775 shipments involving about 6200 packages which includes most of the plutonium shipped in the past four years. (auth)

33040 (CONF-740901-P3, pp 1148-1161) FRACTIONAL AIRBORNE RELEASE OF PLUTONIUM UNDER SHIPPING ACCIDENT CONDITIONS. Mishima, J. (Battelle Pacific Northwest Labs., Richland, WA). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The quantity of hazardous material which will be injected into the atmosphere under specific conditions is required to pre-evaluate the potential radiological consequences from a postulated accident. Lack of data on the characteristics and behavior of plutonium aerosols generated under accident conditions make evaluation difficult even if all accident conditions could be quantified. The reported data on the fractional airborne release of plutonium and some plutonium compounds available was compiled and it applied to some situations found in transportation accidents. Under most conditions studied the fractional airborne from powder (activity median aerodynamic diameter approximately 1 μm) was greater than from nitrate solutions. (auth)

33041 (CONF-740901-P3, pp 1162-1171) POTENTIAL ENVIRONMENTAL CONSEQUENCES OF POSTULATED TRANSPORTATION ACCIDENTS INVOLVING PLUTONIUM SHIPMENTS. Watson, E. C. (Battelle Pacific Northwest Labs., Richland, WA). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

A method for estimating the dose to human lungs and bone, via inhalation, following an accidental release of plutonium to the atmosphere is described. (auth)

33042 (CONF-740901-P3, pp 1172-1184) RISK ANALYSIS OF SHIPPING PLUTONIUM OXIDE AND PLUTONIUM NITRATE. McSweeney, T. I.; Brown, C. L.; Heaberlin, S. W.; Mishima, J.;

Watson, E. C.; Hall, R. J.; Kelly, W. S.; Davis, D. K.; Liu, S. N.; Williams, L. D. (Battelle Pacific Northwest Labs., Richland, WA). 1974.

From 4th international symposium on packaging and transportation of radioactive materials; Miami Beach, Florida, USA (22 Sep 1974).

In proceedings of the 4th international symposium on packaging and transportation of radioactive materials.

The application of a model for assessing the risk of shipping radioactive material, by analysis of the shipment of plutonium, by truck in the form of oxide and liquid nitrate is demonstrated. (auth)

33043 (Y-DR-128) CRITICAL EXPERIMENTS WITH UF_6 CYLINDER MODEL 8A CONTAINERS. Thomas, J. T. (Oak Ridge Y-12 Plant, Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 33p. Dep. NTIS $4.75.

Some critical conditions were measured for U(97.7)F_6 contained in Model 8A shipping containers. As many as 16 cylinders were available and were arranged in a number of arrays under various reflector conditions. Polyethylene and concrete were utilized as the reflector materials and Plexiglas was used as an hydrogenous material interspersed between the cylinders in a few experiments. Among the many experiments with and perturbations to the critical arrays are several demonstrating neutron coupling between two arrays through a 50.8-cm thickness of concrete. (auth)

33044 TRANSPORT OF IRRADIATED FUEL AND CONTROL RODS FROM A DECOMMISSIONED POWER REACTOR. Pryor, W. A. (Oak Ridge Operations Office, TN). pp 419-431 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The decommissioning of the Boiling Nuclear Superheater (BONUS) Reactor in Rincon, Puerto Rico, involved the transport of irradiated fuel elements of two different ^{235}U enrichments and configurations as well as the shim and control rods to the continental United States of America for reprocessing and disposal, respectively. The responsibility was assigned by the US Atomic Energy Commission (USAEC) to its Oak Ridge Operations Office. The initial task was to select a cask on the bases of safety, economy, and logistics. Compatibility for transport by both land and sea was also a significant criterion for selection. Subsequent tasks included the preparation of the cask and special equipment, transportation arrangements, documentation, and shipment execution. Safety considerations were factored into each phase including the conducting of a critical experiment with spare unirradiated fuel elements which were available. Safety Analysis Reports were prepared for the cask and for the fuel and control-rod baskets. Trial runs with the cask and special equipment were conducted in Oak Ridge prior to shipment to Puerto Rico. During the transport phase, the cask made seven trips between the United States and Puerto Rico and approximately 30,000 miles were logged. The applicable regulations of the USAEC and the Department of Transportation were followed. Unusual occurrences included threatened and actual strikes of longshoremen, a breakdown at sea, and a "lost" shipment. The completed tasks represented the co-operative efforts of two USAEC Operations Offices and two USAEC prime contractor organizations. Actual experiences are reviewed and recommendations based on these experiences are presented. (auth)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstracts 33863 and 33942.

33045 (AD-778313) REPORT OF LINAC OPERATION. Interim Report No. 14, 1 January–31 December 1973. (Naval Research Lab., Washington, D. C. (USA)). Apr 1974. 45p. (NRL-MR-2768). NTIS $3.25.

The operation and use of the NRL 60-MeV electron linac is described for the period 1 January–31 December 1973. Highlights of the applied and basic research programs are reviewed. The applied programs include radiation effects on electronics, photoactivation analysis, and neutron and x-ray diagnostic studies in laser-fusion and exploding wire plasmas. The basic programs include 180 degree electron-nuclear scattering and neutron time-of-flight research. The linac was manned for 3919 hours, which breaks down to 3076 hours for beam and set-up time (including 546 hours for outside users), 828 hours for maintenance and improvements, and 15 hours lost to breakdowns. A bibliography is included as well as a brief description of linac use by other groups. (auth)

33046 (CONF-730618-, pp 75-92) NEW TRENDS IN THE USE OF ACCELERATORS IN SOLID STATE PHYSICS. Dearnaley, G. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The new developments discussed include (1) the growth of ion implantation in areas other than semiconductor devices, and (2) the use of ion accelerators as increasingly sophisticated probes of solid surfaces. Ion implantation of semiconductors has been carried out with currents ranging from a few μA to several mA, and equipment capable of producing these beams is now commercially available. Most other materials require substantially larger doses of impurities in order to modify their corrosion behaviour, mechanical properties, magnetic properties, etc. New demands are being placed on the accelerators with which to carry out research and practical applications in this field. These requirements are discussed in the light of experimental results obtained in work on the implantation of metals and alloys. Ion backscattering and ion-induced characteristic x-ray measurement have become established probing techniques in solid-state physics. Because of the quantitative nature of the data, and the depth resolution which can be achieved, these methods are increasingly widely used. It has now become possible to carry out these experiments with highly-focused ion beams, sometimes only 4 μm in diameter. Applications of such techniques in solid-state physics and microelectronics are discussed. (auth)

33047 (CONF-730618-, pp 180-185) HIGH VOLTAGE MASS SEPARATOR AT THE CHALK RIVER NUCLEAR LABORATORIES. Brown, F. (Chalk River Nuclear Labs., Ont.). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

This accelerator is designed to combine, as far as possible, the advantages of an electromagnetic isotope separator, an ion implantation machine and an accelerator for atomic collision studies. The accelerator itself is a specially modified pelletron, which is an electrostatic type machine operating in a pressure tank. Special features include a rapid "turn around" time for removing and replacing the pressure tank, differential pumping in the terminal and the ability to use ion sources requiring high power and heat dissipation. The terminal voltage is 2 MV. Mass separation is achieved by a double focussing, 90° sector magnet, with a radius of 2 meters and a mass-energy product of 480. The flight path accommodates a mass dispersion of 8%, with moveable pick-up slits so that a selected mass beam can be used for energy control while another mass beam is used for experiment. This facility can therefore provide, in principle, beams of any ions to be used for either stable or radioactive nuclides. Further details of the design are given together with available operating experience. (SW)

33048 (CONF-730618-, pp 199-204) UNIVERSAL RANGE ION ACCELERATOR AND SEPARATOR. Sidenius, G.; Holck, O. (Niels Bohr Inst., Copenhagen). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A description is given of the reconstruction of the close to 30 years old Copenhagen separator into a modern universal ion accelerator and separator. By applying a retardation-post acceleration technique, but with the target at ground potential, it has been possible to obtain a continuously variable ion energy from about 100 eV up to 70 keV. The energy variation has no influence on the mass position and has only a very slight influence on the ion current to the target in the energy range from 1 keV and above. All important parameters including the gas flow to the ion source are highly stabilized, resulting in a very stable beam current to the target. A short description of some of the most important parts of the electronic system including a simple but rather accurate massmeter is given. (SW)

33049 (CONF-730618-, pp 307-317) HIGH ENERGY CHEMISTRY WITH LOW ENERGY ACCELERATORS. Wolf, G. K. (Univ., Heidelberg). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Implantation of energetic ions is a technique extensively used in the field of solid state physics. In contrast applications of this method to chemical problems are only little known, despite of the fact that accelerated ions may induce unusual chemical reactions and effects. A status report of the activity of the Heidelberg-Karlsruhe Group in this field is presented. A 100 keV ion accelerator with a 30° magnet equipped with a specially designed inlet and cooled target system and a 30 keV ion accelerator without magnet are used for the production of energetic ions. As examples for the possibilities of the method, results on different subjects are reported: (1) Studies of radiation damage which occurs in chemical compounds used as targets in high energy heavy ion accelerators—the conditions may be simulated with low energy accelerators. (2) Syntheses of chemical compounds in micro quantities, especially compounds being difficult to prepare with normal chemical procedures. (3) Investigations on the mechanism of chemical reactions of energetic ions in solids. (4) Investigation on chemical reactions of energetic ions with gaseous targets. For this field a combination of a low energy accelerator with a quadrupole mass spectrometer is under development. (auth)

33050 (CONF-740653-5) INTRODUCTION TO FERMILAB. Einhorn, M. B. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). Jul 1974. 33p. Dep. NTIS $4.75.

From 9th symposium on particle physics; Balatonfured, Hungary (12 Jun 1974).

Following an illustrated description of the Laboratory's natural site and resources, the accelerator, its characteristics, and its performance record to date are described. The four experimental areas, i.e., internal target area, neutrino area, proton area, and meson laboratory are discussed. Beams available to each area are indicated. Experiments which are underway, as being set up, or have recently been completed are mentioned. (auth)

33051 (DEU-73-22) PROGRESS REPORT 1971 OF THE ACCELERATOR LABORATORY OF THE UNIVERSITY AND TECHNICAL UNIVERSITY OF MUNICH. Santo, R.; Gernhardt, G.; Hering, W.; Konecny, E. (comps.). (Muenchen Univ. (F. R. Germany); Technische Univ. Muenchen (F. R. Germany)). 1971. 106p. (In German).

The annual report gives a review of the operation of the tandem accelerator. Since 1971 the accelerator has been operating on a regular 24 hour shift basis. With the existing measuring equipment, heavy ion reactions, nuclear reactions with light particles, Coulomb excitations and nuclear fission processes have been investigated. In addition, the work of the theoretical groups is described. (GE)

33052 (GSI-72-9) UNILAC PROJECT. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). May 1972. 26p. (In German).

A review is given on the aims of GSI and of the UNILAC project. The physical background of the heavy ion linear accelerator is described, followed by a description of its main components. (auth)

33053 (GSI-72-11) UNILAC. Progress Report No. 6. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Dec 1972. 32p. (In German).

This report comprises a general status report and in addition four special notes on the production of highly charged metal ions in a duoplasmatron ion source, the UNILAC test-injector, power tests on a quarter wave coaxial cavity, and on the selection of the geometrical dimensions for the UNILAC Alvarez cavities. (GE)

33054 (GSI-73-1) UNILAC. Progress Report No. 7. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Feb 1973. 26p. (In German).

The following topics are discussed: geometrical, electrical and magnetic properties of the quadrupoles designed to meet the focusing requirements, measurement of rf-leakage of coaxial con-

nectors, nondestructive bunch phase angle measurement, pulse generators for ion sources, and the GSI cavity plating plant. (GE)

33055 (GSI-PB-1-74) UNILAC. Project Report No. 11. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Feb 1974. 50p. (In German). INIS.

With figs.; tabs. and refs. With abstracts in English.

This status report (covering the period from October to December 1973) outlines the activities and work performed regarding the construction, placing of orders and planning for the following fields: Ion beam injection, beam transport, r.f. supply and acceleration structures, systems control/electronics, (data handling, operating, beam diagnostics, electrical engineering) technology (drift tubes, inner conductors, spoke wheels, membranes, copper-plating, assembly). Detailed reports deal with the following individual subjects: Properties of a Duopigatron highly-charged ion source (combination of duoplasmatron and penning discharge), the beam transport system between ion source and Wideroee-accelerator (ion optical design), regulation of the resonance frequency of the acceleration structures, detection of spark discharges in the r.f. power line, the cooling system of the GSI laboratory, and selection of a large data processing system. (GE)

33056 (GSI-PB-2-74) UNILAC. Project Report No. 12. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Jun 1974. 35p. (In German). INIS.

With figs.; tabs. and refs. With abstracts in English.

This status report (covering the period from January to March 1974) outlines the activities and work performed regarding the construction, placing of orders and planning for the following fields: Ion beam injection, beam transport, r.f. supply and acceleration structures, systems control/electronics (process computer, beam diagnostics, data handling, electrical engineering), technology (tape transport device, Wien filter as heavy-ion separator, large and small heavy-ion scattering chamber, foil delivering device, target chamber, outer and inner drift tubes for the Wideroee structure, inner conductors, spoke wheels, copperplating, assembly work for Wideroee and Alvarez). Detailed reports deal with the following topics: The vacuum system of the UNILAC, (design and construction, coupling with the computer illustrated by the example of beam injection, operation control by the main control room), status report of the working group for the on-line mass separator, (separator instrumentation, development of ion sources and targets), a tape transport system in connection with an on-line mass separator, radiation damage and voids in technical alloys. (GE)

33057 (IPP-0/20) REVIEW ON ELECTRON RING ACCELERATION. Schumacher, U. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Dec 1973. 35p. INIS.

6 figs.; 138 refs. With abstract.

A review of the theories and experiments on electron ring accelerators is given. The principles of collective ion acceleration using relativistic electron rings in different acceleration structures (electric fields and expanding magnetic fields) are described and the conditions for forming and accelerating ion loaded electron rings are given. There are single-particle resonances and collective instabilities which have to be avoided in carefully designed collective accelerators, so as not to lose the effectiveness of this acceleration principle. The current experiments and their results are described. (auth)

33058 (IPP-0/22) HIGH-VOLTAGE GENERATOR WITH PULSE-CHARGED BLUMLEIN CABLE FOR THE GENERATION OF PULSED RELATIVISTIC ELECTRON BEAMS. Schilling, H. B.; Buchelt, E.; Siller, G. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1974. 17p. (In German). INIS.

16 figs.; 5 refs. With abstract.

An apparatus for the production of pulsed relativistic electron beams is described. The generator, consisting of a pulse-charged Blumlein-cable and a field-emission electron tube produces rectangular pulses of 60 ns duration with beam currents of 14 kA and electron energies up to 550 keV. The energy-spread of the beam is of the order of 10%. (auth)

33059 (KFTI-73-26, pp 3-4) ABOUT PRECISION BEAM PRODUCTION FROM THE 2 GeV ELECTRON LINAC. Artemov, V. I.; Grishaev, I. A.; Dem'yanenko, G. K.; Dovbnya, A. N.; Peev, F. A. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

The effect of instability of the parameters of a beam of electrons in the 2-GeV electron linac is discussed. The dependence of the emittance on the number of pulses, the beam current, and the change in the horizontal dimension during a current pulse at critical current values were studied. (INIS)

33060 (KFTI-73-26, pp 39-42) BEAM EMITTANCE MEASUREMENT ON LU I-2 OUTPUT. Batalin, V. A.; Kolomiets, A. A.; Kuibida, R. P. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

The results of measurements of the beam emittance at the output from a linear accelerator by a two-slit method are presented. Curves of equal phase density, constructed from the results of the measurements, indicate that the beam at the accelerator outlet diverge and that the shape of its emittance was close to elliptical. Emittances are compared at two different injection currents. The density of the accelerator beam at optimum adjustment increased with increase in the accelerator current. The highest value of the accelerator current for which emittance measurements are given was 180 mA. The time dependence of the value and shape of the emittance on the beam current pulse was studied. The time dependence is very weak and may be neglected in most cases. (INIS)

33061 (KFTI-73-26, pp 51-52) INTEGRAL ELECTRON CURRENT MEASUREMENT ON KHAR'KOV LINEAR ELECTRON ACCELERATOR OUTPUT. Bezmenshchikova, L. A.; Dobrolyubov, Yu. I. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

A scheme is presented for measuring an average beam current without interrupting the beam. The electron current recorder is a volume resonator at the accelerator output. The current is recorded by a self-registering potentiometer and digital voltmeter with a coded output for transmission of the values to the computer. (INIS)

33062 (KFTI-73-26, pp 68-69) PRODUCTION OF THE SINGLE ACCELERATED ELECTRONS FOR SPECTROMETRIC APPARATUS CALIBRATION. Shramenko, B. I.; Grishaev, I. A.; Krinitsyn, A. N.; Kovalenko, N. A.; Denisov, Eh. I.; Glebov, V. I. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High physics and nuclear physics.

A method for obtaining isolated electrons in a "dark" electron accelerator regime is described. High-potential electron beams are not included but the incandescent glow is. In addition, there was narrow dispersion on the "dark" electron path. The use of this regime for calibrating spectroscopic apparatus with a high speed of response is described. The work was carried out on a 2-GeV linear electron accelerator. (INIS)

33063 (LA-5707-MS) MANAGEMENT INFORMATION FOR LAMPF. Jameson, R. A.; Mills, R. S.; Johnston, M. D. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1974. Contract W-7405-eng-36. 62p. Dep. NTIS $5.45.

Various types of information are required on a continuing basis for the operation, maintenance, scheduling, budgeting, and general support of a large accelerator facility. Modern general purpose file management and information retrieval systems allow the operating division to concentrate on its information needs with minimal programming investment. This report covers the operational aspects of various data-bases and the associated information retrieval and reporting now in use and under development. (auth)

33064 (NP-20118) ANNUAL REPORT, 1973. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 19 Mar 1974. 145p. Dep. NTIS (US Sales Only) $10.25.

This report covers activities from April to December 1973. The INS 160-cm cyclotron was operated in the FM acceleration mode. Protons with energies up to 50 MeV were used for (p,t) nuclear reactions and in-beam gamma-ray spectroscopy. ^{3}He particles were accelerated up to 80 MeV, and experiments of elastic, inelastic, (^{3}He,α), and (^{3}He,d) reactions were carried out. It was observed that (^{3}He,α) reactions with medium-heavy nuclei enhance excitation of deeply bound high-spin neutron orbits to disclose them as strong peaks on continuum spectra. The new variable-energy cyclotron was completed; the proton energy is expected to be about 40 MeV. At the electron synchrotron, a photon tagging system was installed. By use of an absorber method in the extraction of the electron beam from the synchrotron, it became possible to do experiments using tagged photons without significant effects on experiments by the main users of the machine. Two experiments to study photoproduction in the resonance

region were performed. Polarized target symmetry was measured in the reaction of $\gamma p \rightarrow n\pi^+$ and $\gamma p \rightarrow p\pi^0$ by using a He^3-cooled butanol target with an average photon polarization of about 65%. Measurement of the cross sections of the reactions $\gamma p \rightarrow p\pi^0$ and $\gamma n \rightarrow n\pi^0$ was done to check the possible existence of the isotensor current in the region of the first resonance. Continuous efforts were devoted to studying large air showers (10^{17} eV), horizontal air showers, and so on. A series of large-area emulsion chamber (~130 m^2) exposures was continued on the top of Mt. Fuji with a view to obtaining new information on nuclear interactions as well as on the primary cosmic rays at 10^{15} eV–10^{17} eV or more. Work in theoretical physics, chemistry, accelerator operation, computer services, and general facilities is also reported, along with the usual staff and publications lists. Items with significant amounts of information are title listed separately. (RWR)

For title listings of individual papers see: 33130–33134, 33564, 33791, 33804–33810, 33832, 33833, 33843, 33844, 33853, 33867–33870, 33904, 33905, 33921, and 33922.

33065 COMMISSIONING OF LINEAR ACCELERATOR SECTION IN HIGH-FREQUENCY QUADRUPOLE FOCUSING. Il'evskii, S. A.; Kapchinskii, I. M.; Kuznetsov, G. F.; Mal'tsev, A. P.; Mirzoev, K. G.; Nizhegorodtsev, V. V.; Stepanov, V. B.; Teplyakov, V. A.; Kholodenko, M. A.; Shalashov, I. M. Sov. At. Energy (Engl. Transl.); 34: No. 1, 77-79(Jan 1973).

Translated from At. Energ. (USSR); 34: No. 1, 56-58(Jan 1973).

Research on the design and operation of a small compact proton linac using quadrupole focusing is outlined. The basic parameters of an accelerator section are listed. (WHK)

33066 LINEAR RESONANCE ACCELERATOR WITH A STEADY ELECTRON FLUX. Snedkov, B. A.; Turenko, B. A. Sov. At. Energy (Engl. Transl.); 34: No. 1, 74-76(Jan 1973).

Translated from At. Energ. (USSR); 34: No. 1, 55-56(Jan 1973).

The characteristics of a linear, resonance high-frequency accelerator for monoenergetic electrons are presented. (WHK)

33067 FIRST SUCCESSFUL EXPERIMENTS WITH THE RING CYCLOTRON AND FIRST PRODUCTION OF PIONS AT THE SIN. Phys. Bl.; 30: No. 7, 309-312(Jul 1974). (In German). 4 figs.

The course of the first test runs with the SIN ring cyclotron for 590 MeV protons, the results of experiments, and further experiments planned within the program are briefly discussed. (GE)

33068 TOSHIBA MEDICAL LINEAR ACCELERATOR, LMR-4. Hashimoto, K.; Shigemura, N.; Ono, K. (Tokyo Shibaura Electric Co. Ltd., Kawssaki, Japan). Toshiba Rebyu; 29: No. 2, 115-119 (Feb 1974). (In Japanese).

A short and efficient accelerating tube with a magnetically coupled biperiodic structure was developed as a linear accelerator for medical purposes. Provided with regular cells optimized in shunt impedance and buncher cells so designed as to minimize the phase difference between microwave field and electrons under working conditions, this accelerating tube has extremely efficient acceleration and good energy spectrum. Designed to have large coupling among cavities, it operates with high stability. The success in optimization of design has made the tube able to obtain a beam energy of 4 MeV with a tube length reduced to about 30 cm to be constructed in a miniature type, and in consequence to be fitted in the irradiation direction of x rays. Thus it has been improved in operability and reliability. The characteristic features of this linac are: (1) operability and reliability comparable to those of ^{60}Co therapeutic equipment, (2) large output, (3) small focus, (4) large irradiation field, (5) high level of control, etc. The equipment is economical and may be substituted for ^{60}Co therapeutic units. (auth)

Auxiliaries and Components

Refer also to abstract 32659.

33069 (CONF-721228-, pp 477-486) MANUFACTURE OF MAGNET BLOCK CASTINGS FOR CYCLOTRON. Das, D. K.; Prabhu, B. V. (Heavy Engineering Corp. Ltd., Ranchi, India). 1972.

From conference on electrical, electronic and magnetic materials; Madras, India (7 Dec 1972).

In 1968, the Bhabha Atomic Research Center, approached Foundry Forge Plant of Heavy Engg, Corp. Ltd. for the manufacture of sophisticated magnet block castings consisting of 12 pieces, each weighing over 20 tons in very low carbon steel. Even though there was no vacuum degassing arrangement for the manufacture of this steel, the order was accepted with a view to gain developmental experience. This paper deals with manufacturing these magnet blocks in the steel foundry. Sample test blocks belonging to this material were also tested for magnetic properties at B.A.R.C.'s Laboratory at Calcutta and the results were found to be extremely successful. (auth)

33070 (INIS-mf-1364) CERN SPS MULTICOMPUTER AND CAMAC REAL-TIME CONTROL SYSTEM. Crowley-Milling, M. C.; Altaber, J.; Collins, M.; Hyman, T.; Rausch, R.; Shering G.; Wilhelm, R. (European Organization for Nuclear Research, Geneva (Switzerland)). [nd]. 6p. INIS.

From one international symposium on CAMAC in real-time computer applications; Luxemburg (4 Dec 1973).

A new concept of CAMAC, allowing critical real-time operation and using a modular CAMAC multicontroller approach, will be applied to the SPS multicomputer control system. Programmed I/O operation, interleaved DMA, fast interrupt logic and autonomous operation in the same CAMAC crate will be used. A typical application of this concept to a high-speed high-precision analogue data acquisition system is given. CAMAC will be used to interface general purpose multiplexers which drive very large quantities of accelerator control equipment. (INIS)

33071 (JINR-13-7010) TECHNIQUE FOR PRODUCING THE LUMINESCENT SCREENS FOR MEASURING CHARGED PARTICLE BEAM PROFILES. Zhil'tsova, L. Ya.; Larin, A. A.; Shafranov, M. D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 5p. (In Russian). INIS.

A method is proposed for preparing a luminescent screen which assures a homogeneous distribution of luminophore over the area in order to increase the accuracy of measuring the parameters of ionizing radiation beam profiles and the quantitative determination of the number of particles by photometry. The screens were made by block polymerization in glass forms with a low temperature initiator in a water bath at room temperature. Luminescent screens are used for handling the slow withdrawal of protons at a beam density of 2 to 5×10^{12} particles/cm^2 and for visually observing ionizing radiation beam profiles. (SJR)

33072 (KFTI-73-26, pp 20-21) METHOD OF THE SHORT BUNCHES FORMATION. Dovbnya, A. N.; Mocheshnikov, N. I.; Petrenko, V. V. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High physics and nuclear physics.

A system is described for forming short clusters of particles which, unlike "electron drums" is practically without aberration. (INIS)

33073 (KFTI-73-26, pp 37-38) EQUIPMENT FOR AUTOMATIC MEASUREMENT OF BEAM EMITTANCE ON ACCELERATOR OUTPUT. Artemov, V. I.; Grigor'eva, L. S.; Dem'yanenko, G. K.; Lizunkov, V. I.; Peev, F. A.; Reprintsev, L. V. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High physics and nuclear physics.

A planar ionization chamber is described. It has high spatial resolving capacity and may be used as a detector for an accelerator charged-particle beam. A block diagram of the experimental construction for automatic measurement of the beam emittance is given in which a planar ionization chamber is shown. With a dispersion collimator and the planar ionization chamber it is possible to measure a beam energy of from several MeV up to 2 and more GeV; the dynamic range of beam intensity of 5×10^{-10} to 5×10^{-7} may be broadened with some worsening of the space or angular dispersion. (INIS)

33074 (ZFK-268) NANOSECOND PULSING OF DIRECT CURRENT ACCELERATORS. Lehmann, D.; Seeliger, D.; Sgonina, A. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Feb 1974. 36p. (In German). Dep. NTIS (US Sales Only) $5.00.

A survey on the possibility of pulsing dc accelerators is presented. Beam chopping and different methods of beam bunching are described. The possibility of klystron bunching are treated. The different pulsing systems are compared with respect to the experimental conditions, such as burst duration, energy spreading, background, angular spreading etc. Advantages of the combination of various methods are discussed. The special problems of beam pulsing of Cockcroft-Walton, Van de Graaff, and tandem accelerators are treated. (90 references) (auth)

33075 POWER FOR SINGLE-BUNCH ACCELERATION BY A SYSTEM OF RF CAVITIES. Serov, V. L.; Orlov, Yu. F.; Baryshev, A. I. At. Energ. (USSR); 37: No. 1, 39-42(Jul 1974). (In Russian).

Power optimization for a system of rf cavities to accelerate

single, dense bunches of charged particles was carried out. Linear and circular accelerators are considered. (auth)

Ion Sources and Injection and Extraction Systems

Refer also to abstract 33964.

33076 (KFTI-73-26, pp 14-15) STUDY ON THE BEAM RADIAL-ANGLE CHARACTERISTICS OF THE INJECTOR ACCELERATOR. Artemov, V. I.; Vishnyakov, V. A.; Dovbnya, A. N.; Dem'yanenko, G. K.; Lizunkov, V. I.; Peev, F. A. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High physics and nuclear physics.

A method of constructing a focusing system for an injector with gradual change in the phase rate of the wave is described, and the results of measurements of the radial and angular properties of the electron beam (intensity and emittance and phase density of the beam as a function of the lens current) are reported. The injector studied permits obtaining beams with much higher phase density, which makes its use feasible for a 2-GeV multi-section linear electron accelerator. (INIS)

33077 (KFTI-73-26, pp 28-30) FOCUSING SYSTEM OF THE EREVAN SYNCHROTRON LINOTRON-INJECTOR. Ryabtsov, A. V.; Danilin, V. G. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High physics and nuclear physics.

A two-solenoid focusing system for the linotron scheme of the positron accelerator of the Erevan synchrotron was studied. The calculation was carried out by a matrix method. The pulsed positron current, ready for injection into the ring was 2 mA for a bombarding-electron current of 0.56 A and energy of 188 MeV. The positron energy at the synchrotron entrance was 233 MeV. (INIS)

33078 GENERATION OF INTENSE BEAMS OF MULTIPLY CHARGED IONS. Properties of Classical Multiply Charged Ion Sources and Some New Configurations. Winter, H. (Technische Hochschule, Vienna (Austria). 2. Inst. fuer Experimentalphysik). Vakuum-Tech.; 23: No. 3, 70-77(Apr 1974). (In German).

9 figs.; 4 tabs.; 22 refs.

Sources for generation of intense beams of multiply charged ions suitable for injection into accelerating systems are characterized by use of some basic parameters. Although during recent years some new configurations have been proposed and investigated up to now only classical ion sources seem to be suitable for practical use. Applying simple calculations the properties of such ion sources can be determined approximately. By combining different principles of function of classical ion sources in some cases a better adaptation to experimental needs can be achieved. (auth)

Ion Optics and Field Calculations

33079 (CERN-74-14) NUMERICAL COMPUTATION OF FIELD DISTRIBUTION AND FREQUENCY IN THE LOWER PASSBANDS OF A SYMMETRICAL PERIODIC STRUCTURE. Part II. Results. Bell, M.; Dome, G. (European Organization for Nuclear Research, Geneva (Switzerland)). 15 Jul 1974. 90p.

An earlier report (CERN 73-1, Laboratory I, Proton Synchrotron Department) described a method of computing by relaxation methods the electromagnetic fields and the frequency at any mode in the lower passbands of a symmetrical periodic structure, for a travelling wave as well as for a standing wave. In this report the results obtained for an Alvarez structure without stems are presented. (auth)

33080 (IPP-0/21) SIMULATION OF RELATIVISTIC ELECTRON RINGS IN QUASI-EQUILIBRIUM. Hofmann, I. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Feb 1974. 37p. INIS.

15 figs.; 1 tab.; 22 refs. With abstract.

An electron ring model and numerical code are developed to describe the quasi-equilibrium behavior of ion-loaded rings, including inhomogeneous space charge effects and a realistic ion distribution function. The model uses distribution functions that solve the Vlasov equations using appropriate adiabatic invariants. The potentials for electric and magnetic self-fields are calculated in toroidal geometry with a quick 2 D-Poisson solver. Self-consistency is obtained by iterative solution of the resulting coupled nonlinear integro-differential equations. The numerical code is applied to accelerated rings, and the dependence of the holding power on ion loading and close boundaries is studied. (auth)

33081 (ISN-7403) CONFIGURATION OF THE PRINCIPAL FIELD OF THE GRENOBLE CYCLOTRON. Ferme, J. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). 29 Jan 1974. 69p. (In French). Dep. NTIS (US Sales Only) $6.50.

The field configuration of the Grenoble cyclotron with a current of 678 amp to the principal coils was calculated. The configuration fulfills the conditions of isochronous functioning for all ions. The modifications desired for the field can be achieved by correction coils. The computer programs used in the calculation of the field configuration are described in detail. They are the TRAJ 11 AND TRAJ 22 programs for the calculation of equilibrium orbits, ISO 1 program for the calculation of the strong focusing term for each equilibrium orbit, BK program for the calculation of the field and of $k = -n$ as a function of the radius, and ISO 2 for the approximate calculation of the dephasing of a particle in a magnetic field close to the synchronous field. (JSR)

33082 (ISN-7412) MEMORY AID FOR THE USE OF THE PROGRAMS FOR THE CALCULATION OF FIRST ORDER TRAJECTORIES OF THE OPTIC SERIES. Ferme, J. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). 15 May 1974. 70p. (In French). Dep. NTIS (US Sales Only) $6.50.

The OPTIC series programs have been used to calculate, to first order, particle trajectories in optical systems composed of dipole and quadrupole magnets. These programs are adapted for use on a PDP 9 or PDP 15 computer with input/output by teletype. (auth)

33083 (KFTI-73-26, pp 5-6) DECREASING CHROMATIC ABERRATIONS IN BEAM TRANSPORT SYSTEM OF THE 2 GeV ELECTRON LINAC. Artemov, V. I.; Grishaev, I. A.; Dovbnya, A. N.; Kovalenko, N. A. 1973. (In Russian).

From 10th final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High physics and nuclear physics.

Decrease in the chromatic aberration of an electron beam by introducing into the field a lens of the nonlinear component is proposed. The problem was solved by shunting of the lens winding. Introduction of a quadratic nonlinear constituent field into quadripolar lenses of the beam transport system of a 2-GeV linear electron accelerator decreased the effective emittance of the beam in a horizontal surface 2 to 3 fold. (INIS)

33084 (KFTI-73-26, pp 7-9) EFFECT OF THE TRANSVERSAL RF FIELDS ON THE RADIAL MOTION ON MULTISECTION LINEAR ACCELERATORS. Artemov, V. I.; Grishaev, I. A.; Dovbnya, A. N.; Peev, F. A. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high energy physics and nuclear physics.

The interaction of a beam with fields of matching elements of the accelerating sections of a multisection accelerator was studied. Measurements were made of the resulting transverse pulses of particles going through the accelerating system under conditions of measurements of the phase velocity of the waves in the section. The dynamics of the beam in the accelerator with displacement of the frequencies of the accelerating field to 660 kHz were studied. The emittance of the beam decreased 3-fold. Control by a phase shift of the transverse fields in harmony made it possible to improve the radial properties of the beam in work with a high-frequency accelerator field although the accelerator energy was somewhat decreased. (INIS)

33085 (KFTI-73-26, pp 10-11) STUDY ON FOCUSING OF THE BEAM TRANSPORT SYSTEM OF THE 2 GeV ELECTRON LINAC. Artemov, V. I.; Grishaev, I. A.; Dovbnya, A. N.; Kovalenko, N. A. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high physics and nuclear physics.

The focusing properties of the beam transport system of a 2-GeV linear electron accelerator were studied. The dependence of the beam emittance at the accelerator and transport system exits and of the energy spread on the collimator dimensions and the dependence of beam emittance at the transport system exit on the energy spread of the beam were studied. In the present form of the beam transport system, emittance is increased 8-

fold. The system has high chromatic aberration. The limiting value of the beam emittance at the transport system exit was 5×10^{-4} Mrads. (INIS)

33086 (KFTI-73-26, pp 12-13) STUDY ON SOME METHODS OF THE DECREASING OF THE BEAM EMITTANCE ON THE EXIT BEAM TRANSPORT SYSTEM. Artemov, V. I.; Grishaev, I. A.; Dovbnya, A. N.; Kovalenko, N. A. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high energy physics and nuclear physics.

Operation of the beam transport system in different regimes was studied for the purpose of decreasing the beam emittance. The focusing properties of the reversing magnet were studied in a regime with the central lens focusing the beam in a horizontal plane. The optimum angles of entrance and exit cutting of the magnet were found. The beam emittance in operation with a new regime in the horizontal plane was a third that of the usual operation but in the vertical plane did not change. (tr-auth)

33087 (KFTI-73-26, pp 16-19) 5-LENSES ACHROMATIC BEAM TRANSPORT SYSTEM OF THE 2 GeV ELECTRON LINAC. Grishaev, I. A.; Dovbnya, A. N.; Kovalenko, N. A. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high energy physics and nuclear physics.

The increasing experimental requirements for the parameters of the accelerator beam are a problem for the reconstruction of the beam transport system of the 2-GeV electron linac. Theoretical studies were made on some variants of the axiomatic systems. After comparison of the parameters of the basic variants, a five-lens system was selected which has a number of advantages over the system in use. The trajectories of the particles in the horizontal and vertical planes agree independently of the beam parameters at the system entrance. The system has a much lower chromatic aberration, which may be compensated by making corrections on the magnetic field of the lenses by shunting of the feed winding. Introduction of the five-lens variant allows significant broadening of the range of physical experiments and carrying out phase compression of the beam in order to improve its monochromaticity. The theoretical value of the effective emittance of the beam at the target is decreased 8-fold. (INIS)

33088 (KFTI-73-26, pp 31-32) SOME PARAMETER ESTIMATES OF THE LINEAR ACCELERATOR WITH AXIAL INCREASING FOCUSING FIELD. Zajdin, A. G. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high energy physics and nuclear physics.

The acceleration of particles in a high-frequency field with longitudinal increase in the amplitude of the accelerating wave was measured. By using this method it is possible to combine the self-phasing of particles with their self-focusing. The focusing properties of these waves for synchronous particles was evaluated. (INIS)

33089 (KFTI-73-26, pp 33) PROGRAM FOR CALCULATION OF THE ELECTRON-OPTICAL SYSTEMS. Oboznyi, V. A. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high physics and nuclear physics.

A program, written in Algol, is given for calculating electron-optical systems. The translator from this programming language is available on all computers. The program is analogous to the Transport program written at Stanford in Fortran for the IBM-360. (INIS)

33090 (KFTI-73-26, pp 34-36) CALCULATION METHOD OF FOCUSING SYSTEM FOR LINEAR ELECTRON ACCELERATOR. Kozlov, V. P.; Shal'nov, A. V. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high energy physics and nuclear physics.

A method for analysis of transverse motion and selection of a focusing system for the injector section based on agreement of beam emittance at the injector section with acceptance of the basic part of the accelerator is proposed. The method is more general than those commonly used, requires less time for numerical calculations, and simplifies analysis of the results from the numerical modeling. (INIS)

33091 (KHFTI-73-12) INVESTIGATION OF THE FIELD SECTION COMPENSATING CONDITIONS IN THE ACCELERATING STRUCTURE OF THE RESONATOR WITH DRIFT TUBES. Bomko, V. A.; Rudyak, B. I. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1973. 19p. (In Russian). INIS.

The results of the experimental study of the processes of compensation of sections of the longitudinal fields of the resonator wave type consisting of the E_{011} spectrum were described. The compensation is done with a resonator installation interacting with the fields of these types of waves. The process of conversion of the types of waves into bound waves was shown and the sequence of the field conversion was traced. The location of the waveguide stub guaranteeing the greatest bounding coefficient was determined. (tr-auth)

33092 (UCRL-Trans-1515) IMPEDANCE OF AN ELECTRON RING SCREENED WITH INTERNAL COAXIAL CYLINDER. Aleksakhin, Yu. I.; Sarantsev, Y. P. (Joint Inst. for Nuclear Research, Dubna (USSR)). Mar 1974. Translation by G. Brodell of JINR-P9-7357. 18p. Dep. NTIS $4.00.

One of the principal concerns that appears in developing a collective method of acceleration, is the question of stability of an electron ring regarding all kinds of perturbations. In particular, the basic limitations on the electron ring parameters (energy straggling, number of electrons and, consequently, an effective accelerating voltage) are connected with the development of azimuthal (longitudinal) instabilities. The most effective method of suppressing these instabilities is by screening the ring in order to decrease the size of the impedance. The effect of screening an electron ring with radius r_0, moving nonrelativistically over an internal coaxial tube of radius d, upon the size of the impedance was studied. The impedance was determined by the relation of $2\pi r_0 E_{n\theta} = -Z_n I_n$, where $I_n = I_{n0} e^{i(n\theta - kct)}$ is the perturbation of the beam current and $E_{n\theta}$ is the azimuthal electric field created at the ring radius. The adgezator (compression) chamber is presented as a coaxial resonator and the accelerating circuit as an infinite coaxial waveguide. (WHK)

33093 STUDIES ON THE PARTICLE DYNAMICS IN THE HELICAL ACCELERATOR FOR HEAVY IONS. Klabunde, J. Frankfurt, Ger.; Frankfurt Univ. (1970). 156p. (In German). INIS.

Thesis. 49 figs.; 3 tabs.; 55 refs. with abstract. Available from the library of the Frankfurt Univ.

The following subjects are dealt with: basic theory of the helical accelerator; the electromagnetic fields in the helix; general equations of motion; longitudinal particle dynamics (energy-phase oscillations, WKB approximation, energy-phase acceptance, asynchronous acceleration); radial motion in linear approximation (theory for periodic systems); numerical solutions of the equations of motion (determination of radial and longitudinal acceptance and emittance considering the influence of coupling effects and rf phase adjustment errors); the flexibility of the helical accelerator (energy variation, acceleration of all ions of the periodic system, simultaneous acceleration of several charge states of an ion, acceleration with constant phase velocity in particular sections); and effect of standing waves on the particle dynamics. (GE)

33094 SYNCHRONOUS MOTION OF CHARGED PARTICLES IN A TRAVELING-WAVE FIELD. Mokhov, V. M.; Kushin, V. V. Sov. At. Energy (Engl. Transl.); 34: No. 3, 267-268(Mar 1973).

Translated from At. Energ. (USSR); 34: No. 3, 209-210(Mar 1973).

According to the principle of phase stability, the accelerated particles in the field of a traveling wave group into bunches near the stable equilibrium phase which is unique in the cycle of rf oscillations. However, if the field phase varies in the direction of propagation of the wave, then there arises the possibility of a second stable phase, which leads to the formation of two stable bunches in every cycle of rf oscillations. In the present work, the conditions in which there arise two stable synchronous phases in the traveling wave whose amplitude and phase vary periodically in the direction of particle motion are investigated. (WHK)

Storage Rings

33095 (KFTI-73-26, pp 43-44) DEVICE FOR THE ADIABATIC INCREASING OF PARTICLE ENERGY IN N-100 INSTALLATION; RESULTS OF OPERATION. Arnautov, Yu. G.; Markov, V. V.; Tolstoi, A. E. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high physics and nuclear physics.

A scheme is given for stabilizing the current of the magnets of the storage device which ensures an adiabatic regime for increasing the energy of the stored particles from 100 to 110 MeV for a 70-MeV injection energy. A new element in the scheme is a precision potentiometer with linear properties. (INIS)

33096 (RL-74-071) EPIC MAIN RING QUADRUPOLES. Armstrong, A. G. A. M. (Science Research Council, Chilton (UK). Rutherford Lab.). 20 Jun 1974. 14p. (EPIC/MC-50). Dep. NTIS (US Sales Only) $4.00.

Some parameters of the EPIC main ring quadrupole magnets are summarized in a set of tables so that cost estimates can be made. Some tentative costs are shown. (auth)

33097 (RL-74-090) EPIC MAIN RING DIPOLE MAGNETS. Armstrong, A. G. A. M. (Science Research Council, Chilton (UK). Rutherford Lab.). 4 Jul 1974. 11p. (EPIC/MC-53). Dep. NTIS (US Sales Only) $4.00.

The principal parameters of the dipole magnets for the EPIC main ring are summarized in a set of tables, including some tentative costs. (auth)

33098 (RL-74-097) OUTLINE OF EPIC COOLING SYSTEM. Goodyer, P. T. J.; Brooks, H. C. (Science Research Council, Chilton (UK). Rutherford Lab.). 22 Jun 1974. 6p. (EPIC/MC-55). Dep. NTIS (US Sales Only) $4.00.

The following items are briefly described: 1) Epic tunnel ventilation, 2) Epic vacuum vessel cooling, 3) RF equipment cooling and equipment cooling in intersection areas 1 and 3, 4) Epic magnet system cooling and equipment cooling in intersection areas 2 and 4, 5) cooling in injector, booster and transfer areas, and 6) raw softened water system. The main parameters of the cooling systems are tabulated and the proposals made in the text are shown diagramatically. (UK)

33099 (RL-74-099) PRELIMINARY PROPOSALS FOR AC DISTRIBUTION SYSTEM FOR EPIC. Tolcher, R.; Brooks, H. C. (Science Research Council, Chilton (UK). Rutherford Lab.). 27 Jun 1974. 5p. (EPIC/MC-57). Dep. NTIS (US Sales Only) $4.00.

The following items are briefly described: (1) the method of feeding the ring magnet system and the RF system for Epic, (2) the proposed method of feeding load requirements at the intersection regions, (3) the arrangement for supplying the electron and positron linac systems, the transfer lines (linacs to booster), the booster and the booster to Epic transfer system, and (4) other general requirements. The main values of installed MVA proposed at this time are tabulated and the proposals made in the text are shown diagramatically. (UK)

33100 (RL-74-101) OUTLINE PROPOSALS FOR EPIC MAGNET POWER SUPPLIES. Wheldon, A. G.; Brooks, H. C. (Science Research Council, Chilton (UK). Rutherford Lab.). Jul 1974. 7p. (EPIC/MC-58). Dep. NTIS (US Sales Only) $4.00.

The present Epic magnet system consists of almost 200 separately controlled magnet circuits, having a total power consumption of about 5 MW. Where practicable, magnets requiring the same current conditions throughout the Epic pulse have been connected in series to minimize the cost of power supplies, cabling, and control circuitry. To some extent magnet currents have been chosen to minimize tunnel cooling loads and cable costs. Information about the various circuits is shown in a table and a diagram. A series connection has been chosen for each of the circuits 1 to 19 inclusive so that each circuit forms a large closed turn around the Epic ring. The effects of external interference upon these large closed turns will require further investigation in order to ensure that magnet current tolerances can be maintained under all conditions. Discussion is under the headings: control and protection of the power supplies, power supply arrangements and location, and cabling. (UK)

33101 (RL-74-102) RESONANCE METHOD TO PRODUCE A POLARIZATION ASYMMETRY IN ELECTRON–POSITRON STORAGE RINGS. Toner, W. T. (Science Research Council, Chilton (UK). Rutherford Lab.). Jul 1974. 7p. Dep. NTIS (US Sales Only) $4.00.

Pulsed solenoids of a few tens of ampere turns, operated in synchronism with the $\gamma(g-2/2)$'th harmonic of the orbit period, can be used to prevent a stored electron beam from becoming polarized through the emission of synchrotron radiation. With such low fields it is easy to arrange that only some of the stored bunches are affected. This makes it possible to produce collisions between counter-rotating electrons and positrons stored in a single ring in which the electron and positron polarizations are not equal and opposite. (auth)

33102 STORING OF ELECTRONS AND POSITRONS IN THE DORIS STORAGE RING AT DESY. Wiedemann, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Phys. Bl.; 30: No. 5, 215-219(May 1974). (In German).

1 fig.

An easily understandable brief presentation of the manner of functioning and main components of the e^-e^+-DORIS storage ring at DESY is given. (GE)

Experimental Facilities

Refer also to abstracts 32263, 32306, 33833, and 34053.

33103 (ANL/NDM-9) METHOD OF NEUTRON ACTIVATION CROSS SECTION MEASUREMENT FOR E_n = 5.5 TO 10 MeV USING THE D(d,n)^{3}He REACTION AS A NEUTRON SOURCE. Smith, D. L.; Meadows, J. W. (Argonne National Lab., Ill. (USA)). Aug 1974. Contract W-31-109-eng-38. 37p. Dep. NTIS $5.00.

Neutron-cross-section measurements for E_n = 5.5 to 10 MeV can be effectively performed by using the D(d,n)^{3}He reaction as a source of predominantly monoenergetic neutrons. Relatively intense neutron production was achieved by using deuteron beams from the Argonne National Laboratory Fast Neutron Generator (FNG) in conjunction with a deuterium gas cell target. The objective of this report is to describe the experimental and data analysis procedures which are employed in a program of neutron activation cross section measurements in this energy region. (2 figures, 7 tables) (auth)

33104 (CONF-730618-, pp 220-225) VELOCITY FILTER FOR THE SEPARATION OF PROJECTILES AND REACTION PRODUCTS BEHIND THE TARGET OF A HEAVY ION ACCELERATOR. Ewald, H.; Hinckel, P.; Muenzenberg, G.; Nickel, F.; Guettner, K.; Wollnik, H. (Physikalisches Institut, Giessen, Ger.). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Behind a thin target of the heavy ion accelerator near Darmstadt (GSI) the beam will consist of 10^{12} to 10^{13} fast projectiles/sec (with $\beta \sim 0.1$) and not more than 10^7 recoiling reaction products/sec which in most cases have smaller velocities ($\beta \sim 0.01$ to 0.1). The properties of these products shall be examined. The first problem is to deflect the projectiles out of the beam of the products. This separation can be achieved with a focusing velocity filter consisting of separated magnetic and electric fields. We have developed the theory of such filters which eliminate the projectiles and refocus the selected reaction products achromatically on a 4-mm-diaphragm. The focusing is achieved for broad ranges of about ±10% widths of the energies, the masses and the ionic charge numbers of these particles. Several kinds of such velocity filters are considered. Each consists of two separated field Wien filters. The first Wien filter eliminates the primary particles. The second Wien filter is for the compensation to zero of the velocity dispersion of the selected products which is produced by the first Wien filter. (SW)

33105 (CONF-730618-, pp 268-270) VELOCITY SEPARATION OF HEAVY IONS BY HIGH FREQUENCY DEFLECTION. Krueger, F. R.; Persson, B. I.; Kankeleit, E. (Technische Hochschule, Darmstadt, Ger.). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Due to the broad charge distribution of the ions, pure magnetic or pure electrostatic separation of the nuclei of interest from projectiles and background is not feasible for separation of superheavy element recoils at the UNILAC. However, the velocities are well defined by the kinematic, practically to ±1%. As the production cross sections will be very small (~1 nb) and as only thin targets (less than 1 mg/cm^2) can be used due to the energy loss, the beam of wanted particles has to be separated very well from the projectiles. While a static Wien-filter will separate the particles only according to their velocities, the HF-Separator will in addition separate according to the travel time of the particles. As the consequence one can remove beam particles, which have been slowed down at places outside the target (especially in the edges of beam defining slits) and thereby obtain a velocity near that of the compound nuclei. (SW)

33106 (CONF-730618-, pp 271-275) PROGRESS REPORT ON THE ION IMPLANTATION FACILITY AT ORSAY. Chaumont, J.; Lalu, F.; Salome, M.; Seide, C. (Laboratoire Rene Bernas, Orsay, France). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The basis for this ion implanter is a very small Orsay-type isotope separator. The ion source can deliver a total ionic current greater than 1 mA for all elements except platinum. More than 35 elements have been used. After mass separation the

maximum ionic currents, according to the element, range between 40 and 400 μA for singly charged ions, 10 and 100 μA for doubly charged ions, 1 and 20 μA for triply charged ions. For B, Al, Si and P, various mixtures have been tested as load material for the ion source. The ion implanter part proper of this machine includes: (1) an xy electrostatic scan which homogenizes the implanted dose; (2) a six-position sample holder at ground potential (maximum target size is 50×100 mm^2); (3) an insulated six-position sample holder for post acceleration or retardation purpose; and (4) a sample holder provided with a goniometer for single crystals alignment. Inside the ion implanter, the orientation of the crystals is obtained by use of 50 keV protons. The accuracy is better than ±0.5°. (SW)

33107 (CONF-730618-, pp 276-296) VERSATILE ISOTOPE SEPARATOR SYSTEM FOR ION IMPLANTATION AND ION-SURFACE INTERACTION STUDIES. Colligan, J. S. (Univ. of Salford, Eng.); Freeman, J. H.; Grant, W. A.; Nobes, M. J.; Lewis, G. W. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

An apparatus is described which is capable of producing isotopic beams of most species in the energy range from 50 eV to 300 keV. Under normal operating voltages (>5 keV), milliampere beams are usual while at low extraction voltages (down to ~500 eV) useful microampere beams are available. Extraction at normal voltages and subsequent retardation also provides microampere beams. The basic machine is a commercially available isotope separator, fitted with a Harwell ion source, and having variable-geometry pole tips which allow the dispersion, divergence and focal length of the ion beam to be controlled over wide limits. This versatility has been exploited in the addition of on-line facilities to allow a range of experimental investigations to be undertaken. The latter include not only ion implantation for electrical and chemical modification of materials but also sputtering, radiation damage, surface analysis, gas collision and deposition experiments. The characteristics of the ion source and beam handling system are discussed in particular the behaviour of the source at low extraction voltages, the emittance of the beam and the focal properties of the 100 keV post-deflection acceleration stage. Preliminary date on the performance of the electrostatic quadrupole lenses and assembly details for transmitting the beam into the target stage of an electron microscope or an ultrahigh vacuum chamber are also discussed. (SW)

33108 (CONF-730618-, pp 318-323) UNISOR PROJECT. Spejewski, E. H.; Mlekodaj, R. L.; Carter, H. K. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The UNISOR facility, an isotope separator on-line at the Oak Ridge Isochronous Cyclotron, is described. Operation of the facility both in off-line and on-line modes is discussed, the latter with particular emphasis on the target/ion-source combinations under development. These are of two types: a helium-jet feeding into the separator ion source; and a "Pingis-type" with the target forming part of the anode cylinder wall of the ion source. Both types have operated successfully in the on-line system, although efficiencies are low. Source handling techniques, including a tape transport system, are also discussed. (SW)

33109 (CONF-730618-, pp 324-329) PLANS FOR AN ON-LINE MASS SEPARATOR AT THE HEAVY ION ACCELERATOR UNILAC AT DARMSTADT. Roeckl, E. (Gesellschaft fuer Schwerionenforschung mbh, Darmstadt, Ger.); Dumanski, W.; Kirchner, R.; Lauppe, W. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The project of putting a mass separator on line with the beam of the heavy ion accelerator UNILAC at Darmstadt is introduced. The UNILAC is planned to produce ions up to uranium with an energy of 10 MeV/nucleon at an intensity of 3.10^{12} ions/sec. According to the present schedule the first beam will be available for experiments by the beginning of 1975. With the aim of developing on-line techniques for this purpose, an ISOLDE-type separator has been installed at an external beam of the pulsed reactor TRIGA at Mainz. First experiences on the separator performance and on on-line experiments with a uranium stearate target are reported. In cooperation with radiochemists from the universities of Darmstadt, Heidelberg and Marburg different possible target-ion source systems are under investigation, special attention being paid to the release of reactions products as volatile compounds. (SW)

33110 (CONF-730618-, pp 330-334) PINGIS: AN ISOL-SYSTEM AT A CYCLOTRON FOR HEAVY IONS. Fransson, K.; af Uglas, M.; Engstroem, A. (Research Inst. for Physics, Stockholm). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

An isotope separator for on-line operation at the 225-cm cyclotron in Stockholm has been constructed for studies of nuclides far from the line of beta stability and produced by heavy ion reactions. Its ability to prepare mass separated samples suitable for nuclear spectroscopy has been demonstrated for both neutron rich and neutron deficient nuclides. The equipment was tested in June 1969 by the separation of known mercury isotopes produced by (α,xn) reactions on platinum. The major part of the work has involved studies of separated products from alpha-particle induced fission of uranium. The beam of heavy ions extracted from the cyclotron is focused on a solid target inside the separator ion source. The nuclear reaction products are continuously released and ionized in the discharge chamber at high temperature. Beams of electromagnetically separated nuclides are collected in front of various radiation detectors. A detector arrangement suitable for coincidence measurements on very short-lived isotopes is described as well as a tape transport system for the collected radioactive samples. The temperature of the target-ion source (1500°C measured both optically and thermoelectrically) has permitted the separation of a large number of elements produced in fission. The most short-lived nuclides so far observed are ^{129}Ag($T_{\frac{1}{2}}$ = 0.3 s) and ^{96}Rb($T_{\frac{1}{2}}$ = 0.2 s). (SW)

33111 (CONF-730618-, pp 335-340) RECONSTRUCTED ISOLDE FACILITY AT CERN. Sundell, S.; Hansen, P. G.; Jonson, B.; Kugler, E.; Ravn, H. L.; Westgaard, L. (CERN, Geneva). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Plans for the reconstruction of the ISOLDE facility at CERN are discussed. This work is to go on in parallel with a major reconstruction of the CERN synchrocyclotron, for which one hopes to increase the intensity of the extracted beam of 600 MeV protons by as much as a factor 100, or, to approximately 10 μA. The proposed layout for ISOLDE-2 is very different from the present one, partly because of experience gained during more than 5 years of operation, and partly because of the expected greatly increased radiation levels. The solution adopted has a double shielding wall with two moving doors. The analyzing magnet is now built into the shield nearest to the target, so that the (present) long drift tube is avoided. The second shield is placed after the collector chamber and switchyard of the separator, so that the high level of radioactivity at this point will not interfere with the experiments. The experimental area is planned with four secondary beam lines. One of these will have a second magnetic-analysis stage with relatively low dispersion; this very pure beam should be important for work on products with very low sections. (SW)

33112 (CONF-730618-, pp 341-345) ORSAY ON LINE SEPARATOR. Foucher, R. (Institut de Physique Nucleaire, Orsay, France); Paris, P.; Sarrouy, J. L. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A planned separator on-line with the Orsay synchrocyclotron (external beam: about 0.2 μA of 155 MeV p, also α and ^{3}He particles) is described. The first stage is constituted by a 75° magnet with non uniform field (n = 0.5). The dispersion at the collector will be 2000. The distance between target and source is short and adjustable from 30 cm to zero. On the contrary, the distance between source and magnet is large: 1.80 m. The whole of the first stage is located in an unsafe radioactive area and will be controlled from the outside. From the collector, two masses will be deflected by electrostatic condensers (one of them being translatable along the focal plane) and carried beyond the last protective concrete wall. One of the beams is again analyzed by a second magnetic stage which, in addition, switches between three possible deviations. The intensity extracted from the ion source will be usually small, but the possibility of extracting high currents can be very useful for instance to handle sources with strong gaseous carrier. So, no limitation has to be expected on this point. The first target works at high temperature and can melt some refractory metals such as platinum. (SW)

33113 (CONF-730618-, pp 349-354) NUCLEAR SPECTROSCOPY USING ON-LINE MASS-SEPARATOR IN LENINGRAD SYNCHROCYCLOTRON. Berlovich, E. E.; Ignatenko, E. I.; Novikov, Yu. N. (Leningrad Inst. of Nuclear Physics). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A short description of the IRIS (Investigation of Radioactive Isotopes at the Synchrocyclotron) system using on-line mass-separator is presented. The IRIS system is based on the 1-GeV proton synchrocyclotron. It is placed in a special annex closest to the experimental hall of the accelerator. The schematic plan of different system assemblies in the annex is shown. The building

consists of the bunker for the targets and for the input part of the mass-separator and experimental hall, divided by a 6 m iron shielding wall. Beam focusing is carried out by quadrupole lenses placed in the bunker. Target devices have specific construction features depending on physical and chemical properties of radioactive products extracted. Storage for changeable targets and special jib for their transportations are provided in the bunker. The system described uses a mass-separator of Scandinavian type made by the firm "Nucletec". (SW)

33114 (CONF-730618-, pp 405-409) PLANS FOR ON-LINE ATOMIC-BEAM EXPERIMENTS AT THE ISOLDE FACILITY. Ekstroem, C. (Chalmers Univ. of Tech., Goteborg); Lindgren, I.; Olsmats, M. Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

On-line atomic-beam magnetic resonance experiments are planned at the ISOLDE facility, mainly for determinations of spins of nuclear ground (and metastable) states. The atomic-beam method is in principle applicable to all elements that have paramagnetic electronic ground states and do not have extremely high evaporation temperatures. The method is to a large extent complementary to the optical-pumping technique, the latter working mainly on elements with $^1S_0$ electronic ground states. The production rate required for a spin measurement depends on a number of factors. The more important ones are listed and a typical value given for each of them. (SW)

33115 (CONF-730618-, pp 410-411) SIMPLE SOURCE-COLLECTING SYSTEM FOR OFF-LINE WORK. Hoeglund, A. (Univ. of Stockholm). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A collecting system is described which can easily be fully automatized. The system is designed for source collection in a mass-separated ion beam. When not in use, the system can be removed from the beam rapidly, with preservation of the vacuum. (auth)

33116 (KFTI-73-26, pp 22-27) OPTIMIZATION OF THE ELECTRON BEAM INJECTION FROM INJECTOR-LINAC TO STORAGE RING. Rakityanskii, A. A.; Tkachenko, V. D.; Shenderovich, A. M. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high energy physics and nuclear physics.

A system of introducing an electron beam into a storage ring using screening of the beam and formation of a compensating magnetic field is described, and results of work on optimization of the system are reported. The system of compensation ensures 100% conduction of the energy to the storage ring with the same percentage energy scatter. The data indicate the possibility of multiform injection to the storage ring. (INIS)

33117 (KFTI-73-26, pp 66-67) ANNIHILATION GAMMA-QUANTA FROM THE 2 GeV ELECTRON LINAC. Bulyak, E. V.; Grishaev, I. A.; Zhebrovskii, Yu. B.; Krinitsyn, A. N.; Kulibaba, V. I.; Kasilov, V. I.; Kovalenko, N. A.; Kovalenko, G. D.; Morokhovskii, V. L.; Shramenko, B. I. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI An Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high energy physics and nuclear physics.

A scheme is described for obtaining a quasi-monochromatic gamma beam by annihilation of a positron beam on a beryllium target. The experiment was carried out on a linear electron accelerator with a positron beam with E = 1000 ± 10 MeV and a rate of 5×10^9 positrons per second. The spectra obtained for the annihilation photons are presented along with the photons from an electron beam of the same energy for comparison. (INIS)

33118 (KFTI-73-26, pp 72-75) TEST FACILITY "RADIANT" FOR INVESTIGATIONS ON RADIATION PHYSICS. Antipenko, A. P.; Vaikhbrot, E. I.; Grishaev, I. A.; Makhnenko, L. A.; Nosov, V. M.; Ryabka, P. M.; Shubko, V. A.; Khejfets, M. I. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high physics and nuclear physics.

The component parts of the test stand "Radiant" are described briefly. It is based on a 300-MeV linear electron accelerator. The beam exit channel, the target magnet, the high-vacuum furnace for annealing samples, the system connecting objects for study to the measuring apparatus, and the system for adjusting samples are described, and beam parameters are given. The stand is designed for studying the action of relativistic electrons and gamma quanta on crystal structure, especially semiconductors; testing radiation stability of various materials, apparatus, and equipment; and studying the possibility of directional changes in physical properties of apparatus and materials. (INIS)

33119 (KFTI-73-26, pp 96-98) POSITRON PRODUCTION BY ELECTRON SYNCHROTON BREMSSTRAHLUNG. Potemkin, G. V.; Vorob'ev, S. A. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high energy physics and nuclear physics.

The conversion of bremsstrahlung to low-energy positrons was studied. The dependence of the conversion coefficient on positron energy for Pb and Cu convertors of different thicknesses with $E_{\gamma\,max}$ = 800 MeV was determined. (INIS)

33120 (RC-8-1974) USE OF THE CYCLOTRON FOR THE PRODUCTION OF RADIOISOTOPES. Popa, L. I. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 17p. (In Rumanian). Dep. NTIS (US Sales Only) $4.00.

The cyclotron offers a potentially powerful tool to technical, industry, and biomedical centers. With this accelerator one can produce a variety of short-lived nuclides that are unavailable from other sources. The conditions for production of the isotopes are discussed. (auth)

33121 (UCRL-51634) MODEL FOR TRITIUM AND DEUTERIUM TRANSPORT IN TARGETS FOR NEUTRON GENERATORS. Logan, C. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Aug 1974. Contract W-7405-eng-48. 13p. Dep. NTIS $4.00.

The observed behavior of titanium tritide targets used for 14-MeV neutron generation indicates that two mechanisms for tritium motion are active. A model is proposed based on thermally induced motion of tritium and deuterium in gamma phase hydride plus a radiation-induced component dependent on the incident ion current density. The model describes the observed behavior and permits speculation regarding target life under different operating conditions. (auth)

33122 DESIGN OF PION AND MUON CHANNELS. Al-Quazzaz, N. M. M. Victoria, B. C.; Univ. of Victoria (1973). National Library of Canada, Ottawa.

Thesis (Ph. D.).

Various concepts for the transport of pions and muons from production targets external to the TRIUMF accelerator have been studied. A dual purpose magnetic channel capable of providing a pion beam and a muon beam has been designed. Phase One of the system consists of five quadrupoles and two bending magnets, and forms the pion collection section of the muon channel. It also serves as a stopped pion channel. The maximum solid angle of acceptance of this channel is 26 msr and the range of accepted momenta extends 17.5% on each side of the central momentum. For a 100 μA proton beam incident on a 10 cm long beryllium target, the calculated maximum stopping density of pions in an area of 25 cm × 25 cm is 1×10^8 $\pi^-(\text{sec}\cdot\text{g/cm}^2)^{-1}$ when the channel is operated at a central momentum of 100 MeV/c. A maximum muon stopping density of 7×10^6 $\mu^-(\text{sec}\cdot\text{g/cm}^2)^{-1}$ can be obtained if the pions are separated by range absorption. Better muon beam purity is obtained by tuning the second half of the channel to 90 MeV/c to collect muons from the decay of pions in the backward direction when the first half is set at 160 MeV/c. In this case, a maximum muon stopping density of 1×10^6 $\mu^-(\text{sec}\cdot\text{g/cm}^2)^{-1}$ can be obtained. If a bending magnet is placed after the Phase One system to separate the muons and the pions by momentum analysis, a calculated maximum muon stopping density of 2×10^6 $\mu^-(\text{sec}\cdot\text{g/cm}^2)^{-1}$ can be obtained when the magnet is tuned to 85 MeV/c and the channel is set at 160 MeV/c. Phase Two of the design consists of a long straight alternating gradient section and on analyzing section. The straight section provides an extra 5.5 meter length for pion decay. When the central momentum of the pion collection system is 160 MeV/c and the straight section is tuned to optimize the number of muons from the backward decay of pions, the calculated maximum muon stopping density in a 25 cm × 25 cm area is 1×10^7 $\mu^-(\text{sec}\cdot\text{g/cm}^2)^{-1}$. The analyzing section consists of a 90° bending magnet and a quadrupole triplet. With the pion collection system and the straight section set as described above and the analyzing section tuned to 82 MeV/c, a calculated maximum stopping density is 3.2×10^6 $\mu^-(\text{sec}\cdot\text{g/cm}^2)^{-1}$ in a 25 cm × 25 cm area and 1.1×10^6 $\mu^-(\text{sec}\cdot\text{g/cm}^2)^{-1}$ in a 10 cm × 10 cm area. An average muon polarization of between 70% and 90% may be obtained. The yields of π^+ and μ^+ are about three times larger than the π^- and μ^- yields. The accuracy of the calculation procedures was checked by comparing calculated and measured values for a pion channel, designed and set up at the Lawrence Laboratory at Berkeley. The two sets of values were found in agreement to within experimental error. (Diss. Abstr. Int., B)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

33123 HIGH ENERGY PARTICLES AND QUANTA IN ASTROPHYSICS. McDonald, F. B.; Fichtel, C. E. (eds.). Cambridge, MA; Massachusetts Institute of Technology Press (1974). 486p. $18.50.

The book contains nine chapters. Separate abstracts were prepared for each chapter. (JFP)

For abstracts of individual chapters see: 33124, 33138–33142, 33283, 33284, and 33329.

33124 RADIO ASTRONOMY. Alexander, J.; Clark, T. pp 273-307 of High Energy Particles and Quanta in Astrophysics. McDonald, F. B. (ed.). Cambridge, MA; Massachusetts Inst. of Tech. Press (1974).

The discussion covers the generation and propagation of radio waves and radio-astronomical observations of high energy particles. It is assumed the state of polarization is random. (JFP)

33125 ASTRONOMY AT SUBMILLIMETRE WAVELENGTHS. Rowan-Robinson, M. (Queen Mary Coll., London). New Sci.; 63: No. 905, 78-79(11 Jul 1974).

One of the last astronomical gaps in the electromagnetic spectrum is the submillimetre decade of wave lengths from 100 micrometres to 1 millimetre, that is between the radio and infrared wave lengths. The problem of detection at these wavelengths due to the blanket of atmospheric absorption by water vapour molecules is discussed. However, high altitude observations with solid-state detectors are now beginning to make inroads in this new kind of astronomy which promises to tell more about the centre of the galaxy, about stars at the beginning of their lives, and about the cosmic background radiation. Sources which have been detected in the submillimetre band to date fall into three groups: the galactic centre; hydrogen clouds in the galaxy; and extragalactic sources. Observations on these sources are described. (UK)

33126 VISTAS IN ASTRONOMY. Volume 15. Beer, A. (ed.). New York; Pergamon Press (1973). 197p. $27.00.

Selected topics in astronomy and related sciences are reviewed in survey articles combining original research with an evaluation of the current level of knowledge in the particular discipline. Subjects examined include computer simulation of star cluster dynamics, velocity fields and microturbulence in stellar atmospheres, image tubes used in astronomy, high speed photometric techniques, photopolarimetry of stars and planets, the real lengths of cometary tails, stellar proper motions in reference to galaxies, and neutrinos in the universe. Current trends in research are outlined along with new techniques, their effects on solutions of theoretical problems, and important questions requiring further research. (IAA)

33127 NONLINEAR MODEL FOR THE INTENSITY, LINE WIDTH, AND COHERENCE OF ASTROPHYSICAL MASERS. Rosen, R. A. (Columbia Univ., New York). Astrophys. J. Lett.; 190: No. 2, L73-L76(1 Jun 1974).

The effect of pumping on the steady-state coherent lossless light wave trains which can propagate through a two-level resonant medium is studied. This phenomenon is a form of self-induced transparency. It is shown that for certain kinds of pumping this problem can be solved by assuming slowly varying parameters for the elliptic functions which describe the nonpumped steady-state solutions, as found previously by Eberly and Crisp. The resulting energy density in the field when Doppler broadening predominates grows asymptotically as $(\lambda z)^2$, as expected, where λ is the pump rate and z is the distance of propagation through the medium. The line width of the coherent radiation grows asymptotically proportional to λz. These results are then applied to the physical conditions present in astrophysical clouds from which masing is observed, and it is shown that present observations are consistent with the form of coherent radiation predicted by the model described above. (auth)

Cosmic Radiation

Refer also to abstracts 32256, 32269, 33266, 33576, 33872, and 33964.

33128 (AD-772622) COMPUTER SIMULATIONS OF COSMIC RAY AIR SHOWERS. II. Showers Initiated by Heavy Primary Particles. Dixon, H. E.; Turver, K. E.; Waddington, C. J. (Minnesota Univ., Minneapolis (USA). School of Physics and Astronomy). Nov 1973. 28p. NTIS $3.25.

Computer simulations have been made of large extensive air showers initiated by nuclei heavier than protons. The work forms part of a study of future experiments designed to identify the nature of the energetic primary particles. A model based upon data from nuclear emulsion experiments has been used to represent the break-up of the primary nuclei in collision with air nuclei. Differences in shower characteristics are predicted which are dependent upon the choice of model for the fragmentation of the primary nucleus and its energy. The major cause of fluctuations in the longitudinal development of showers produced by heavy primary particles is shown to be the pattern of the fragmentation of the incident nucleus. (GRA)

33129 (N-74-18420) MAGNETOSPHERIC MODULATION EFFECTS ON SOLAR COSMIC RAYS FROM SIMULTANEOUS OGO 1 AND 3 ION CHAMBER DATA IN 1968 AND 1969. Hofmann, D. J. (Wyoming Univ., Laramie (USA)). Oct 1973. 158p. (NASA-CR-137075). NTIS $11.00.

Simultaneous observations by identical ionization chambers aboard the satellites OGO-1 and OGO-3 are utilized to investigate spatial variations in particle intensity near and inside the magnetosphere during the solar cosmic ray events of September 1966. Cross-correlation of the absolute proton flux computed from the chamber rate during three solar particle events shows good agreement with the measurements by the IMP-F Solar Proton Monitor during the same events. The chamber has a dynamic range of over six orders of magnitude. Before launch it was calibrated in the laboratory with radiation dosages in the range 1 R/hr-6000 R/hr. The OGO-1 and OGO-3 chambers, which were normalized in the laboratory prior to the launch, are found to maintain their normalization within approximately equal to 1% during their flight. The high sensitivity and absolute inter-comparability of the instruments allow small intensity differences to be detected and it is established that the observed differences can be explained by a magnetospheric screening effect when an anisotropic beam of particles is present in space. Evidence is presented to show that the screening is at times complete for a duration of as much as 110 min in the tail of the magnetosphere so that during this period the solar cosmic rays (E approximately equal to 15 MeV) have virtually no access to that region of the magnetosphere. Small intensity fluctuations of a temporal nature were observed and found to be subjected to a damping effect inside the magnetosphere. (auth)

33130 (NP-20118, pp 72-73) AIR SHOWER EXPERIMENTS USING THE INS AIR SHOWER ARRAY: EXPERIMENT ON HORIZONTAL AIR SHOWERS. Mikamo, S. (Tokyo Univ.); Yoshii, H.; Hara, T.; Kawaguchi, S.; Suga, K. 19 Mar 1974.

33131 (NP-20118, pp 73-76) OBSERVATION OF HIGH ENERGY HADRONS IN EXTENSIVE AIR SHOWERS. Matano, T. (Saitama Univ., Urawa, Japan); Machida, M.; Ishizuka, T.; Ohta, K.; Machida, M.; Tsushima, I.; Kawasumi, N.; Hashimoto, K.; Tanahashi, G. 19 Mar 1974.

33132 (NP-20118, pp 76) STUDY OF AIR SHOWERS OF ENERGIES ABOVE 10^{17} eV. Kawaguchi, S. (Tokyo Univ.); Suga, K.; Sakuyama, H.; Takano, M.; Uchino, K.; Hara, T.; Ishikawa, F.; Tanahashi, G. 19 Mar 1974.

33133 (NP-20118, pp 77-79) CHACALTAYA LARGE AIR SHOWER EXPERIMENT. Nagano, M. (Tokyo Univ.); Suga, K.; Kamata, K. 19 Mar 1974.

33134 (NP-20118, pp 91-95) OBSERVATION OF HIGH ENERGY γ-RAYS AND HADRONS AT MT. FUJI WITH FE-EMULSION CHAMBER. Yuda, R. (Kanagawa Univ., Yokohama, Japan); Taira, T.; Shibata, M.; Taira, K. 19 Mar 1974.

33135 (PITHA-61(1972)) MONTE-CARLO STUDY OF THE SPATIAL DEVELOPMENT OF COSMIC RAY SHOWERS IN THE ENERGY RANGE 10^{12} TO 10^{15} eV. Sawaf, Z. (Technische Hochschule Aachen (F. R. Germany). 3. Physikalisches Inst.). Apr 1972. 79p. (In German). INIS.

34 figs.; 35 tabs.; 80 refs. With abstract.

The problem of cosmic-ray showers has been treated with the aid of the Monte-Carlo method. In the first part of this study (chapter 2) electromagnetic cascades are calculated which have been induced in the atmosphere by photons with energies of 10^{12}, 10^{13} and 10^{14} eV. The effects of bremsstrahlung, ionization losses and multiple scattering for electrons and that of pair formation and the Compton effect on photons are taken into account. The results of the Monte-Carlo calculations are compared with those of the analytical theory for electromagnetic showers. In the second part (chapter 3) the behavior of extensive air showers is investigated. Monte-Carlo calculations for primary photons with

energies of 10^{13}, 10^{14} and 10^{15} eV are done using a calculational model of the strong interaction. Lateral distributions as well as energy spectra and other computed data of the various particle components are compared with measurements of the air shower experiments. The shielding of the electromagnetic component by lead layers of different thickness is studied in chapter 4. Shower curves in lead are computed and the absorption factor of lead as a function of the primary energy and the lateral distance is determined. Chapter 5 deals with the problem of the search for quarks in air showers. Due to the lack of adequate theoretical data on quark formation, four computational models are being taken as a basis for this study, with the four models representing extreme alternatives to each other. The distribution of associate particle density and quark ionization is established. (GE)

33136 ANALYSIS OF MUON BUNDLES UNDERGROUND. Totsuka, Y.; Koshiba, M. (Tokyo Univ.). J. Phys. Soc. Jap.; 36: No. 2, 341-350(Feb 1974).

A method of phenomenological analysis of multiple muon events is presented, where the influence of the decay probability of parent mesons is explicitly taken into account and the effect of the finite size of detectors is also included. Our experimental results as well as other existing data deep underground were analyzed, and mutually consistent reasonable fits were obtained for the existing data. (auth)

33137 OBSERVATION OF GALACTIC LINE GAMMA-RAY. Iwama, S. (Rikkyo Univ., Tokyo). Uchusen Kenkyu; 17: No. 4, 567-574(Feb 1973). (In Japanese).

From symposium on charged particles and cosmic radiation; Hamamatsu, Shizuoka, Japan (Dec 1971).

Measurement of the galactic line gamma-ray with solid state detectors is considered. The line gamma-ray is produced by the interaction between low-energy cosmic rays and interstellar gas. The origins may be the excitation of low-energy cosmic rays such as C, N, O, Ne, and so on by collision with the interstellar gas, or the annihilation gamma-ray due to β^+ decay of active nuclei produced by the collision of cosmic rays with the interstellar gas. The flux of charged particles can be estimated from the measurement of intensity of the gamma-ray. Detection of the gamma-ray was made with a Ge(Li) detector cooled by liquid nitrogen and loaded on a balloon. A set of electronic circuits of high resolution was associated with the Ge(Li) detector. The balloon flight performed in 1972 is reported in this paper. The flight time was about 9 hours at an elevation of about 30 km. The high-energy spectrum was taken while the balloon was rising and making horizontal flight. Variation of the intensity of low-energy gamma-ray due to height was taken while the balloon was dropping. The upper limit of flux obtained from the high-energy spectrum was 1×10^{-3} cm^{-2} sec^{-1}. The upper limit obtained from the low-energy spectrum was 10^{-2} cm^{-2} sec^{-1}. It is necessary to reduce the background of air by the measurement at higher position with better resolution. Suppression of air component with a collimator may be effective. (JA)

33138 COSMIC RAY EXPERIMENTAL OBSERVATIONS. Balasubrahmanyan, V. K.; McDonald, F. B. pp 1-53 of High Energy Particles and Quanta in Astrophysics. McDonald, F. B. (ed.). Cambridge, MA; Massachusetts Inst. of Tech. Press (1974).

The discussion covers the experimental techniques, cosmic ray composition, measurements of cosmic ray arrival directions, cosmic ray prehistory, and future experimental developments. (JFP)

33139 ABUNDANCES OF NUCLEI IN THE COSMIC RADIATION. Reames, D. V. pp 54-121 of High Energy Particles and Quanta in Astrophysics. McDonald, F. B. (ed.). Cambridge, MA; Massachusetts Inst. of Tech. Press (1974).

The topics discussed are the physics of nuclear abundances, nuclear fragmentation of cosmic rays, energy loss and atomic processes, propagation of cosmic-ray nuclei, cosmic ray sources, and the future outlook. (JFP)

33140 COSMIC ELECTRONS. Ramaty, R. pp 122-169 of High Energy Particles and Quanta in Astrophysics. McDonald, F. B. (ed.). Cambridge, MA; Massachusetts Inst. of Tech. Press (1974).

The topics discussed are sources of cosmic electrons, propagation of cosmic electrons, and electron observables. (JFP)

33141 COSMIC X-RAY BACKGROUND. Boldt, E. pp 368-427 of High Energy Particles and Quanta in Astrophysics. McDonald, F. B. (ed.). Cambridge, MA; Massachusetts Inst. of Tech. Press (1974).

The treatment covers the observational setting, x radiation by high energy particles, the Milky Way, and the isotropic background. (JFP)

33142 GAMMA RAY ASTRONOMY. Fichtel, C. E.; Kniffen, D. pp 428-470 of High Energy Particles and Quanta in Astrophysics. McDonald, F. B. (ed.). Cambridge, MA; Massachusetts Inst. of Tech. Press (1974).

The topics covered are production mechanisms and sources for celestial gamma rays, and interstellar absorption and detection of gamma rays. (JFP)

33143 INFRARED POLARIZED EMISSION FROM ANISOTROPIC COSMIC DUST. Aiello, S.; Bonetti, A.; Mencaraglia, F. (CNR-GIFCO, Florence). Nuovo Cim., B; 23B: No. 2, 297-312 (11 Oct 1974).

The problem of polarimetric effects of cosmic dust was reviewed, with particular reference to the magnetic alignment mechanism. Aligned anisotropic dust grains are expected to emit detectable polarized radiation in the far infrared region. Polarimetric infrared measurements can contribute effectively to the knowledge of the nature and distribution of dust grains. (auth)

33144 COSMIC BACKGROUND RADIATION. Webster, A. Sci. Amer.; 231: No. 2, 26-33(Aug 1974).

The discussion of the cosmic background radiation includes Olber's paradox, the mapping technique, the origin of the radio background, the history of the universe, the hot-big-bang theory, universe expansion, and the x-ray background. (JFP)

33145 METEORIC VARIATIONS OF COSMIC RAYS. Salimzibarov, R. B. (Inst. of Cosmophysical Investigations and Aeronomy, Yakutsk, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 945-946(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1115(1973).

Substantiation of the existence of cosmic-ray modulation by meteor streams was made and a model of meteor variations of cosmic rays was proposed by Bel'skiy. The interpretation of meteor effects in cosmic rays was based on the assumption that meteoric dust particles have an electrostatic charge. Calculations show that the solar-wind electrons will be entrained by positively charged particles and neutralize even their weak magnetic field. It is concluded that the relationship between cases of Earth's entry into meteor streams and the effects in cosmic rays is dubious and the previously proposed model of meteoric variations of cosmic rays is questionable. (MCW)

33146 EFFECT OF SMALL BURSTS IN THE NEUTRON COMPONENT OF SECONDARY COSMIC RADIATION. Bondarenko, V. I.; Raichenko, L. V.; Yukhimuk, A. K. Kosm. Issled. Ukr.; No. 3, 50-55(1973). (In Russian).

Results of studies on the effect of small bursts, No. 1 and 1^+, in the neutron component of secondary cosmic radiation are presented as data from supermonitors at three different stations. These bursts were shown to be accompanied by an effect in the neutron component of about 0.4%. A mechanism of the acceleration in small bursts of particles by diffusion across the magnetic field of a trap is suggested. (tr-auth)

33147 NATURE OF EXCESS COSMIC RADIATION IN THE REGION OF THE BRAZIL ANOMALY AT HEIGHTS OF 250 TO 500 KM FROM KOSMOS-225 DATA. Raichenko, L. V. Kosm. Issled. Ukr.; No. 3, 55-61(1973). (In Russian).

The results are presented of studies on the anomalous cosmic radiation in the region of the Brazilian magnetic anomaly at heights of 250-500 km based on measurements made on Kosmos-225 (Jun 14-29, 1968). The existence of a stable anomaly of intensity, discovered in the second and third Soviet space ship flights, was confirmed. The complete vector of the geomagnetic field at different heights was compared with maps of the isolines. A high profile of the South Atlantic anomaly of radiation intensity was first obtained with data from the same apparatus. The nature of anomalies of intensity of cosmic radiation over fields of negative magnetic anomalies is discussed. (tr-auth)

33148 USE OF VACUUM UV SOURCES FOR SOLVING PROBLEMS OF COSMIC MATERIAL BEHAVIOR. Verkhovtseva, E. T.; Yaremenko, V. I. Kosm. Issled. Ukr.; No. 3, 66-80(1973). (In Russian).

A problem in cosmic studies is modeling of processes of interaction of vacuum u-v (VUV) radiation of the sun ($\lambda < 2000$ Å) with solid bodies under conditions of cosmic space, i.e., creation of sources of light with dispersion close to that of solar energy. This review of the literature (72 refs) gives evidence of the dispersion of energy of the sun's VUV radiation, formulates requirements of VUV sources used in cosmic materials behavior studies, and critically evaluates the possibilities of using such sources in studies. No source appears to simulate actual conditions satisfactorily. A source has been developed by the Ukr SSR Acad. Sci. based on activation of an ultrasonic gas stream in a vacuum by a dense electron beam. The new source, its spectral properties, and its use are described. (tr-auth)

33149 COSMIC RADIATION AT LOW HEIGHTS. Makhmudov, B. M. (Tashkent State Univ.). Dokl. Akad. Nauk Uzb. SSR; No. 9, 16-18(1973). (In Russian).

Cosmic radiation data recorded on apparatus installed on the Kosmos-228 Sputnik were analyzed. Figures are presented showing the distribution of the intensity of charged particles with energy greater than 60 keV, the angular dependence of electrons of this energy for L shells, and the lifetime of electrons in L shells. Analysis of the data shows that in magnetoscopic time the radiation is dispersed at small angles, and zones of primary destruction of particles can be separated. The data are of considerable interest for studying the mechanism of formation of radiation bands of the earth and of cosmic rays. (TTT)

33150 INSTRUMENT FOR MEASURING FLUXES OF PROTONS AND OF COSMIC-RAY NUCLEI WITH E ≥ 500 MeV/NUCLEON ON UNMANNED PROGNOZ SATELLITES. Blyudov, V. A.; Volodichev, N. N.; Grigorov, N. L.; Kuzin, Yu. N.; Likin, O. B.; Nechaev, O. Yu.; Podorol'skii, A. N.; Savenko, I. A.; Suslov, A. A.; Ustinovshchikov, V. M. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 872-874(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1029-1032(1973).

The scintillation-Cerenkov counter installed on Prognoz, Prognoz 2, and Prognoz 3 to measure the fluxes of protons and nuclei of solar and galactic origin is described. The results of in-flight instrument calibration are reported. (auth)

33151 KINETICS OF COSMIC RAYS IN INTERPLANETARY SPACE IN FRONT OF A MOVING MAGNETIC MIRROR. I. Dorman, L. I.; Shogenov, V. Kh. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 853-856(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1006-1010(1973).

The reflection of cosmic-ray particles from a moving "magnetic mirror" is analyzed on the basis of a kinetic equation. It is demonstrated that a cosmic-ray condensation region forms in front of the mirror and a rarefied region behind it. (auth)

33152 GEMEAUX-S PROJECT. Gros, M. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 187, 41-47(Dec 1973). (In French).

The scientific aims of the Soviet-French experiment Gemeaux-S are described. The variations of the cosmic rays fluxes between Earth and Mars will be measured and a study of the solar flare proton activity will be done. A short technical description of the detector is given and some prospects opened by this experiment for the laboratory of the Service d'Electronique Physique are discussed. (FR)

33153 γ-ASTRONOMY PROJECT: THE COS-B MISSION. Paul, J. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 187, 35-39(Dec 1973). (In French).

In the field of the gamma ray astronomy, the first positive results obtained a few years ago have raised up some ambitious projects. The Service d'Electronique Physique is strongly involved in one of them, the gamma ray astronomy experiment carried by the Esro satellite COS-B. The main features of this project are presented with the performances of the instrument as expected from an accelerator evaluation of a scientific model of the experiment. (FR)

33154 HIGH ENERGY ASTROPHYSICS AT CEA, STATUS AND PROSPECT. Koch, L. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 187, 3-12(Dec 1973). (In French).

Three major fields are investigated in high energy astrophysics by the French Atomic Energy Commission at SEP/SES: X and γ-radiation astronomy; cosmic particle physics (protons, cosmic nuclei and electrons) and nuclear astrophysics which explains the stellar evolution and nucleogenesis using nuclear physics and astronomy data. (FR)

33155 SOME PROBLEMS OF DETERMINATION OF VARIATIONS CAUSED BY EQUIPMENT FOR TELESCOPES. Blokh, Ya. L.; Dorman, L. I.; Libin, I. Ya.; Frantsuz, E. T. Kosm. Luchi; No. 14, 99-112(1974). (In Russian).

The study of cosmic ray intensity variations is one of the most effective means for the investigation of processes taking place in space. At present, however, the accuracy of recordings of cosmic ray intensity does not meet the requirements of the problems solved by experimental data. Considerable increase of recording areas provides a small advantage in accuracy. The effective control of the equipment stability acquires, therefore, great importance. The authors suggest a number of methods for such control, which, moreover, do not need much complication of the equipment itself; they are reliable and allow to carry out continuous control. (auth)

33156 AZIMUTHAL EFFECT IN COSMIC RAYS. Bel'skii, S. A.; Dmitriev, B. A. Kosm. Luchi; No. 14, 29-31(1974). (In Russian).

Data on the azimuthal effect in cosmic rays at geomagnetic latitudes $\lambda = 60°28'$ N and $\lambda = 32°26'$ N in the year 1968 are reported. Comparison between the experimental data relating to the azimuthal cosmic ray intensity dependence shows a discrepancy with the pattern expected from the calculated data on cutoff rigidities. The latter data have been obtained by the trajectory method, the first six terms of the geomagnetic field expansion in spherical harmonics being taken into account. (auth)

33157 ALBEDO PARTICLE DISTRIBUTION ACCORDING TO THE ENERGY OF PRIMARY COSMIC RAY PARTICLES. Skrysbin, N. G.; Sokolov, V. D. Kosm. Luchi; No. 14, 51-53(1974). (In Russian).

Estimates of the expected distribution of albedo particles according to the energy of the primary cosmic ray particles are made in the article through the use of the data of balloon and satellite measurements. The method used for the solution of the problem posed is based on the determination of secondary particle differential multiplicity at different depths in the atmosphere and on the extrapolation of these data to the boundary of the atmosphere. (auth)

33158 SOME PROBLEMS OF THE THEORY OF COSMIC RAY VARIATIONS. Bagdasaryan, M. B.; Gushchina, R. T.; Dorman, L. I.; Pimenov, I. A.; Yanke, V. G. Kosm. Luchi; No. 14, 57-85(1974). (In Russian).

Expressions for barometric coefficients and temperature coefficient density of soft μ-mesons are obtained in the article. Results of numerical calculations are presented in graphical form. General formulas are presented and a calculation scheme for meteorological effects of the cosmic ray hard component is outlined on the assumption of an invariable π-meson production spectrum. Results of the calculations are compared with experimental data on height dependence, angular distribution and energy spectrum of μ-mesons. On the basis of this comparison numerical values of the parameters of the formulas are chosen. Results of the calculations of barometric coefficient and temperature coefficient densities are given in the form of graphical charts for different cases of recording. The problem is being solved of galactic cosmic ray modulation by an expanding spherically symmetric region, the boundary conditions being specified on a moving boundary. It is shown that the problem can be solved analytically on the assumption of a linear dependence of the diffusion coefficient on the distance from the Sun. Heliolatitudinal index HL of solar activity is introduced which allows to take account of the heliolatitudinal distribution of the sunspots and of the variations of the Earth's heliolatitude. Correlation of this index with the cosmic ray intensity variations is analyzed. (auth)

33159 SEARCH OF POINT SOURCES OF GAMMA-QUANTA WITH ENERGY 10^{13} eV. Vladimirskii, B. M.; Pavlov, I. V.; Stepanyan, A. A.; Fomin, V. P. Kosm. Luchi; No. 14, 86-91(1974). (In Russian).

In March 1969 regular observations were commenced at the Crimea Astrophysical Observatory of the Academy of Sciences of the USSR with an instrument for registering Cherenkov flashes of extensive air showers. The instrument consists of two pairs of detectors, provided with parabolic mirrors with a diameter of 1.5 m and a focal length of 0.650 m. At the focal point of each mirror a photomultiplier FEU-52 is installed. The solid angle of the field of vision is 10^{-3} steradian. The detectors are switched on in pairs for coincidence. The resolving time of the coincidence scheme is 5 sec. The average velocity of shower counting for one pair of detectors is 15 to 25 min^{-1}. The current in the photoelectron multiplier called forth by the nightglow is stabilized through use of an illumination lamp. The end-point energy of the registered showers is 10^{13} eV. The scanning technique permitted to observe CP 1133 and HP1507 pulsars. In the direction towards CP 1133 pulsar an intensity increase of 7% ± 3% was observed. (auth)

33160 GEOPHYSICAL EFFECTS AND SECONDARY COSMIC RAY COMPONENTS IN THE ATMOSPHERE. Dorman, L. I. Kosm. Luchi; No. 14, 5-28(1974). (In Russian).

Different geophysical effects of certain cosmic ray components are discussed. The properties of these components are studied in detail and some new hypotheses are presented to account for the mentioned effects. (auth)

33161 STUDY OF GEOMAGNETIC EFFECTS OF COSMIC RAYS BY MEASUREMENTS ON THE RS AKADEMIK KURCHATOV. Avdeev, E. A.; Aleksandrov, V. N.; Bednazhevskii, V. M.; Blokh, Ya. L.; Viskov, V. V.; Dorman, L. I.; Ilgach, S. F.; Kapustin, I. N. Kosm. Luchi; No. 14, 34-50(1974). (In Russian).

A method of approximating the latitudinal dependence of cosmic

rays intensity is dealt with as $I(R) = I_0 [1 - \exp(-\alpha R^{-k})]$. Algorithm of the reduced experimental data processing is presented in Algol-60 language for the purpose of determining the approximating relation I(R) for the TA-IM translator used with the computers of the M-20 type. Primary processing of data obtained through the use of a neutron monitor on board the RS "Academician Kurchatov" is fully described for the period of 1967 and 1968 cruises. Approximating curves for the latitudinal dependence of cosmic ray intensity and coupling coefficients for the region of 0 to 100 GV are presented. Approximating curves drawn with the use of rigidities calculated by Makino are compared with those obtained by numerical integration. (auth)

33162 ELEMENTAL COMPOSITION OF INDIVIDUAL CHONDRULES FROM CARBONACEOUS CHONDRITES, INCLUDING ALLENDE. Osborn, T. W.; Warren, R. G.; Smith, R. H.; Wakita, H.; Zellmer, D. L.; Schmitt, R. A. (Oregon State Univ., Corvallis). Geochim. Cosmochim. Acta; 38: No. 9, 1359-1378(Sep 1974).

Major and trace element analyses of over 180 individual chondrules from 12 carbonaceous chondrites are reported, including individual analyses of 60 chondrules from Pueblito de Allende. Siderophile elements in most chondrules are depleted, compared to the whole chondrite. Correlations of Al-Ir and Ir-Sc among chondrules high in Ca and Al were observed. A Cu-Mn correlation was also found for chondrules from some meteorites. No correlation was observed between Au and other siderophile elements (Fe, Ni, Co and Ir). It is suggested that these elemental associations were present in the material from which the chondrules formed. Compositionally, chondrules appear to be a multicomponent mixture of remelted dust. One component displaying an Al-Ir correlation is identified as Allende-type white aggregates. The other components are a material chemically similar to the present matrix and sulfides-plus-metal material. Abundances of the REE (rare earth elements) were measured in "ordinary" Allende chondrules and were 50% higher than REE abundances in Mokoia chondrules; REE abundances in Ca-Al rich chondrules were similar to REE abundances in Ca-rich white aggregates. (auth)

33163 MULTI-DIRECTIONAL COSMIC RAY INTENSITIES OBSERVED AT MT. NORIKURA AND NAGOYA DURING AUGUST 1972 EVENT. Nagashima, K.; Kondo, I.; Ueno, H.; Fujimoto, K.; Fujii, Z. (Nagoya Univ., Japan). Rep. Ionosphere Space Res. Jap.; 27: No. 4, 170-171(1973).

The rigidity dependence of cosmic ray variation in a selected time interval was obtained from the multi-directional cosmic ray intensity observed at Mt. Norikura and Nagoya during the event in August 1972. The observed cosmic ray intensity is summarized in a table. Assuming a power-law spectrum (P^{γ} dp) for the rigidity dependence of the time variation, the relative intensity change of various components was calculated for $\gamma = 0, -0.25, -0.5, \ldots -2.0$, and was compared with the observed intensity variation. Two specific time intervals during the event were chosen for the analysis, one to represent the gross feature of Forbush decrease, and another to study the nature of short-period increase of the intensity during the storm. It was found that the rigidity dependence of the decrease of cosmic ray intensity on a day-to-day basis fit best with that expected from the power-law rigidity dependence of $\gamma = -0.75$. It was found that the rigidity dependence of the intensity difference between the average for 0300 to 0500 U.T. and that for 0000 to 0200 U.T. was in closest agreement with that expected from the power-law rigidity dependence of $\gamma = -1.5$. (JA)

33164 DIFFUSION OF ^{3}He IN CHONDRITES BY SOLAR HEATING. Lorin de la Grand-Maison, J. C. (Museum National d'Histoire Naturelle, Paris). Compt. Rend., Ser. D; 278: No. 14, 1797-1800(1 Apr 1974). (In French).

The variations observed in the ratio of the ^{3}He and ^{21}Ne spallation isotopes in chondrites can be explained by the existence of a production ratio of 10 and ^{3}He diffusion losses due to solar heating. (auth)

Stars

Refer also to abstracts 33381 and 33893.

33165 (AD-775252) ANTENNA ARRAYS: DESIGN AND THEORY FOR RADIO PULSAR TIMING MEASUREMENTS. Final Report, 1 March 1971-31 August 1973. Scott, J. (Michigan Univ., Ann Arbor (USA)). 15 Feb 1974. Contract N00014-67-A-0181-0037. 39p. (UM/RAO-1974-1). NTIS $3.25.

A study was made of published ratio data on 57 pulsars to determine specifications for an antenna and receiver system for the precise timing of pulsar pulses. The study attempted to optimize the frequency choice, the receiver system, and array size for a given choice of pulsars and timing error. An approximate theory was developed to relate antenna area and pulsar parameters to the timing error. The theory was tested against the pulsar data. Then an array was specified which would give a timing error of less than 100 microsec on 15 pulsars. These results could be used in a feasibility study of a portable navigation system dependent only upon natural extraterrestrial radio signals. (auth)

33166 (N-74-10760) COSMIC SOFT GAMMA-RAY BURSTS AND THE STELLAR SUPER-FLARE HYPOTHESIS. Stecker, F. W.; Frost, K. J. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Nov 1973. 14p. (NASA-TM-X-70513). NTIS $3.00.

From conference on transient cosmic gamma-ray and x-ray sources; Los Alamos, New Mexico, USA (20 Sep 1971).

Cosmic soft gamma ray bursts are discussed, and the stellar super-flare hypothesis is supported. Previous predictions and observations of gamma ray bursts are cited. Studies show that it is plausible that the bursts are caused by the bremsstrahlung of electrons accelerated to high energies in a stellar flare event. Possible observational consequences are listed for the stellar flare hypothesis. (STAR)

33167 DIFFERENTIAL POLARIZATION OF STARLIGHT AS A FUNCTION OF DISTANCE. Lloyd, S.; Harwit, M. O. (Cornell Univ., Ithaca, NY). Int. Astron. Union Symp.; No. 52, 203-207 (1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

The differential polarization was plotted as a function of distance and galactic longitude for 1732 stars between galactic latitudes –5 and +5°. The data were obtained from several published sources. A fairly clearcut distinction is seen between the effects of spiral arms and inter-arm regions indicating that starlight is systematically polarized only when passing through spiral arms. (auth)

33168 SEARCH FOR DIFFUSE INTERSTELLAR FEATURES IN STARS WITH CIRCUMSTELLAR DUST SHELLS. Snow, T. P. Jr; Wallerstein, G. (Washington Univ., Seattle). Int. Astron. Union Symp.; No. 52, 65-70(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Diffuse features at 4430, 5780 and 6613 A were searched for in the spectra of 17 stars which show infra-red excesses or other grounds for believing that they have dusty envelopes. In no case could diffuse bands be identified that may be ascribed to the circumstellar envelope. It is concluded that the grains in circumstellar envelopes are not identical with the grains in the general interstellar medium. (auth)

33169 THEORETICAL INVESTIGATION OF STELLAR ATMOSPHERES WITH SPECIFIC APPLICATION TO THE ATMOSPHERE OF A CARBON STAR R CORONAE BOREALIS. Kawabata, K. University Park, PA; Pennsylvania State Univ. (1973). 402p. University Microfilms Order No. 74-20,931.

Thesis (Ph. D.).

A fine analysis of the hydrogen-deficient carbon star, R Coronae Borealis, is undertaken for the purpose of studying the change in the atmospheric structure for stars with anomalous chemical compositions. To facilitate the treatment of the line spectra for late type stars, such as the present object, the variation of the blended line intensity is considered for two typical cases, viz., a weak line on the wing of an extremely strong line, and the blending of two comparable lines. (Diss. Abstr. Int., B)

33170 MANY-BODY PLASMA CORRECTIONS TO STELLAR THERMONUCLEAR REACTION RATE. Burgoyne, C. M. University Park, PA; Pennsylvania State Univ. (1974). 105p. University Microfilms Order No. 74-20,989.

Thesis (Ph. D.).

Stellar thermonuclear reaction rate equations are reformulated in such a way that the effects of the stellar plasma can be included in a systematic way. The reaction rates are written in terms of the plasma charge density propagator which is investigated. The static limit of the plasma charge density propagator is taken to give the Salpeter electron weak screening theory. Dynamic effects of the plasma on thermonuclear reaction rates are investigated and explicit reaction rate formulas are given. It is found that dynamic effects of the plasma do not make significant changes in thermonuclear reaction rates. It is suggested that the general methods developed in this work can be applied to other types of reactions such as β-decay where dynamic effects of the plasma may be important. (Diss. Abstr. Int., B)

33171 OBSERVATIONS OF LITHIUM DILUTION AND ROTATIONAL VELOCITY DECAY IN F AND G GIANT STARS. Alschuler, W. R. Santa Cruz, CA; Univ. of California (1974). 46p. University Microfilms Order No. 74-20,488.

Thesis (Ph. D.).

Li abundances and rotational velocities were determined for about 70 stars between F4 III and G5 III, from Lick coudé image tube spectrograms of dispersion 16Å mm^{-1}. These results can be compared with theoretical predictions of Li convective dilution and rotational velocity decay for masses 2.4 to 3.0⊙. If all these stars are crossing the Hertzsprung gap for the first time since leaving the main sequence, then theory and observation do not entirely agree. A satisfactory agreement with observation could be achieved by adjustments to the models, possibly through a modification of the mixing-length theory of convection. Without such modifications it would be necessary to assume that there is a systematic increase in the sampled mean mass between F4 III and G5 III, which implies that these samples are drawn from different regions of the ZAMS having different initial Li abundances. (Diss. Abstr. Int., B)

33172 STUDIES OF THE Z CAM TYPE VARIABLE STARS. Robinson, E. L. Jr. Austin, TX; University of Texas (1973). 185p. University Microfilms Order No. 74-5316.

Thesis (Ph. D.).

High speed photometry of Z Cam shows that its light curve bears a strong resemblance to the light curve of U Gem and VV Pup. Strong flickering is always present in Z Cam and has an amplitude correlated with the position of Z Cam in its eruption light cycle. Z Cam does not show eclipses. Low amplitude sinusoidal periodicities were found in the light curve during eruptions with periods between 16 and 19 seconds. A model of Z Cam is constructed whose major new feature is a bright spot on the disk of gas around the white dwarf. The bright spot contributes at least 20 percent of the total light of Z Cam during minima, and is the source of the flickering. The periodicities are interpreted as nonradial pulsations of the white dwarf. On the basis of the pulsations, it is shown that the white dwarf must be the seat of the eruptions. During the eruption the disk of gas increases in radius. (Diss. Abstr. Int., B)

33173 CARBONS AND NITROGEN ABUNDANCES IN METAL-POOR STARS. Sneden, C. A. Austin, TX; University of Texas (1974). 249p. University Microfilms Order No. 74-14,768.

Thesis (Ph. D.).

Abundances of carbon and nitrogen in very metal-poor stars were derived using a spectrum synthesis technique to reproduce the profiles of CH, CN, and NH bands. The observational material consisted of coudé dispersion spectroscopic plates in the blue and near-ultraviolet spectral regions of eleven weak-lined stars, most of which had not been investigated extensively before. For each star, the following analysis procedure was employed. Equivalent widths of unblended atomic lines were measured from tracings of the plate data. Standard curves-of-growth were constructed for neutral and ionized lines of iron, titanium, and chromium. These curves yielded estimates of the effective temperature, surface gravity, and metal abundance of the star. Next, model atmospheres were computed and then tested by using the model and the atomic line equivalent widths in a line analysis program to predict abundances of the atomic lines. A model was deemed satisfactory when it predicted equal abundances for lines of differing equivalent widths, excitation potentials, and ionization states. Finally, a spectrum synthesis program, developed during the course of the research, was used to compute profiles of the CH, CN, and NH bands for various trial values of carbon and nitrogen abundances. By matching synthetic spectra to the tracings of the observed spectra, carbon and nitrogen abundances were derived, subject to uncertainties caused by unknown oxygen abundances in these stars. For one star, HD 122563, an oxygen abundance was also derived from the equivalent width of the [O I] line at 6300 A. The principal results of this study are: carbon is no more deficient than the metals in metal-poor dwarf stars; generally, nitrogen shows no greater deficiency than the metals in the dwarfs, with the possible exception of HD 88609, a star with an extremely high space motion; there is a significant enhancement of nitrogen and depletion of carbon in metal-poor giants. It has further been concluded that the high N/C ratio in giants is due to mixing between atmosphere and the nitrogen-rich, carbon-poor interiors of these stars, rather than a consequence of initial metallicity of the stars. While the program giants tend to be lower in metal content than the dwarfs, other studies have found no carbon anomalies in very metal-poor dwarfs. It is therefore felt that the giants in this study show much evidence of internal stellar evolution. (Diss. Abstr. Int., B)

33174 SPECTROSCOPIC STUDY OF FLARE STARS. Bopp, B. W. Austin, TX; University of Texas (1974). 147p. University Microfilms Order No. 74-14,672.

Thesis (Ph. D.).

Spectroscopic monitoring of the flare stars UV Ceti, BY Dra, YY Gem, YZ CMi, and BD +48° 1958A outside of flare activity reveals that the stars exhibit marked decreases in the Balmer and Ca II emission line strengths over intervals of one day or less. The variations can be explained by a nonuniform, patchy distribution of emitting regions on a rotating star. These regions are assumed to be similar to sunspots: darker than the surrounding photosphere, yet characterized by activity which results in strong local enhancement of the emission lines. This theory is applied quantitatively to explain the V-band variations exhibited by the flare stars BY Dra, CC Eri, and FF And. All three are binaries, and the inclinations of the orbital planes place strong restrictions on the locations of the "star-spots." A model for the spotted areas is developed, incorporating four free parameters: longitude extent, latitude extent, limb darkening, and temperature. It is shown that the spots must be large, covering up to 20% of the stellar hemisphere, and with effective temperatures near 2000 K. In addition, the spots must extend to high latitudes (up to 60°). The model effectively explains the lack of observed (B−V) variations over the photometric cycle: the spot is black at these wavelengths relative to the stellar photosphere. In the case of YY Gem, spectroscopic observations of flares and emission-line variations enable the spots or active regions to be mapped. The resulting limits on the size of the active regions are in agreement with the sizes calculated from the theoretical spot model. Finally, it is noted that the confusing photometric behavior of UZ Lib and LP 101-15 may be effectively explained by star-spots. (Diss. Abstr. Int., B)

33175 TEMPERATURES AND LUMINOSITIES OF M TYPE DWARFS FROM INFRARED PHOTOMETRY. Veeder, G. J. Jr. Pasadena, CA; California Inst. of Tech. (1974). 120p. University Microfilms Order No. 74-14,291.

Thesis (Ph. D.).

Broad-band infrared photometry at 1.65, 2.2 and 3.5μ has yielded the first accurate bolometric magnitudes for a large number of M dwarfs. The intrinsic dispersion in these stars is found to be ~ ±0.4 magnitudes in M_b vs. V−K and M_b vs. R−I magnitude-color diagrams. This dispersion in the lower main sequence may be the result of differential blanketing in the UBVRI filter bands and thus there may be no such thing as a unique main sequence for the intrinsically faint M dwarfs. Scanner observations from 4500 to 10000Å show severe blanketing by TiO in cool M dwarfs, but analysis shows that one parameter is sufficient to describe the blanketing in all of the UBVRI bands for all types of M dwarfs. In general, late M dwarfs seem to have lower effective temperatures than are predicted by theoretical models. Stars with hydrogen lines in emission average 0.2 to 0.3 bolometric magnitudes brighter than M dwarfs without any emission lines. The existence of flare stars with old disk space motions and also the existence of some flare stars below the main sequence complicates the picture of these stars as a pre-main sequence evolutionary stage. M dwarfs that belong to the halo population on the basis of their large space motions tend to be subluminous in M_b vs. V−K and M_b vs. R−I magnitude-color diagrams although there is a large scatter among the few objects of this type. The data for late dwarfs with known masses imply the empirical mass-luminosity relation: $L/L_\odot \propto (M/M_\odot)^{2.2\pm0.2}$ for stars fainter than $M_b = 7.5$. In addition, the late M dwarfs are found to account for all of the "missing mass" in the plane of the galaxy. (Diss. Abstr. Int., B)

33176 PHOTOMETRY OF UV CETI STARS. Moffett, T. J. (Univ. of Texas, Austin). Sky Telesc.; 48: No. 2, 94-96(Aug 1974).

The properties of the class of UV Ceti stars are briefly described. Light curves for flares on YY Geminorum, UV Ceti, CN Leonis, YZ Canis Minoris, and EQ Pegasi are presented. Slow and spike flares are discussed. (7 figures) (RWR)

33177 NEW OBSERVATIONS OF SOME RR LYRAE VARIABLES IN THE GLOBULAR CLUSTER M3 (NGC 5272). Cacciari, C. (Osservatorio Astronomico, Bologna). Astron. Astrophys., Suppl. Ser.; 16: No. 1, 63-69(Jul 1974).

Periods and light curves of 13 RR Lyrae variables in M3 are examined by using all the available observations and a set of new observations taken at the Asiago Observatory in the years 1955 and 1956. For 3 variables alternative periods are given. (4 figures, 2 tables) (auth)

33178 NEW CATALOG OF A STARS WITH PECULIAR SPECTRA (Ap) AND WITH METALLIC LINES (Am). Bertaud, Ch.; Floquet, M. (Observatoire de Paris, Meudon, France). Astron. Astrophys., Suppl. Ser.; 16: No. 1, 71-153(Jul 1974). (In French).

This catalog contains a table of 1049 stars that seem to be well classified. The stars for which spectrograms were obtained only with objective-prism and for which slit-spectrograms would be desirable are indicated. The authors' observations were utilized. A second table gives information relative to 189 stars with more

doubtful classification about which the authors disagree. Some remarks following these two tables indicate other important features, such as nature of visual or spectroscopic binary, optical or spectral variability, and presence of magnetic field. (2 tables, 668 references) (auth)

33179 PHOTOMETRIC STUDY OF THE PULSATING VARIABLE STAR EH LIB. Terzan, A.; Rutily, B. (Observatoire de Lyon, Saint-Genis-Laval, France). Astron. Astrophys., Suppl. Ser.; 16: No. 1, 155-161(Jul 1974). (In French).

New photoelectric observations in U, B, V of the pulsating variable star EH Lib were carried out with the 1m(f/15) photometric telescope of ESO. They enabled the authors to note eight new maxima, to calculate new values of origin O and period P and to write the relation $JJ_{e\,max} = 2.433.438{,}6073 \pm 7 + 0.088413276.E \pm 9$ and to set up a new U−B/B−V diagram. (3 figures, 2 tables) (auth)

33180 SOME DEPENDENCES BETWEEN THE PHOTOMETRIC CHARACTERISTICS OF THE LIGHT CURVES AND THE COLOR INDICES OF CEPHEIDS IN THE SYSTEM U, B, V. II. Nikolov, N.; Momcev, G. Izv. Sekts. Astron., Bulg. Akad. Nauk.; 5: 73-88(1972). (In Bulgarian).

On the basis of rich photoelectric material adjusted to the uniform system U, B, V the dependences between the ratios of the amplitudes of the light curves of cepheids in rays U, B and V and the logarithm of the period P were studied. For all the dependences it was established that up to a certain value of lg P in the interval 0.8 to 1.0 with the increase in the period the ratio of the amplitudes decreases after which with the rise of the period it remains the same. Analytical expressions of these dependences are given. The values fk (k = U, B, V) were obtained, and the dependences between them were studied. The values fk are in close correlation with each other. (auth)

33181 DECAY OF MAGNETIC FIELDS IN STARS. Wright, G. A. E. (Sussex Univ., Brighton, Eng.). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 527-537(Jun 1974).

Assuming that the magnetic stars are in a state of radiative equilibrium with no circulation, it was shown in earlier work that field configurations are possible with surface fields far higher than those observed. It is shown in the present work that normal Ohmic decay could not have dissipated these fields within the stellar lifetime, leading to the conclusion that either the decay is accelerated by the action of instabilities or the star has lost most of its "primeval" flux before reaching the main-sequence. (auth)

33182 ENERGETICS OF BLACK HOLES. Ruffini, R. (Princeton Univ., NJ). pp 451, 453-496 of Black Holes. New York; Gordon and Breach, Science Publishers, Inc. (1973).

From proceedings of the 23rd summer school of theoretical physics; Les Houches, France (1 Aug 1972).

Questions concerning the critical mass of a neutron star are considered, giving attention to special relativity and the concept of critical mass, nuclear interaction and the value of the critical mass, and x-ray sources and the determination of the critical mass. Aspects of electromagnetic radiation in static geometries are discussed, taking into account timelike geodesics in Schwarzschild and Reissner−Nordstrom geometries, electromagnetic perturbations in a static geometry, and electromagnetic radiation from a particle falling radially into a Schwarzschild or Reissner−Nordstrom black hole. Problems of gravitational radiation in Schwarzschild geometries are investigated along with the energetics of black holes. (IAA)

33183 ULTRA-VIOLET OBSERVATIONS OF THE ECLIPSING BINARY STAR DELTA PICTORIS FROM THE TD-1A SATELLITE. Evans, R. G. (Science Research Council, Abingdon, Eng.). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 517-525(Jun 1974).

The B I star δ Pictoris was observed 18 times by the sky survey telescope on the ESRO TD-1A satellite. The spectrophotometric observations in the wave length range 1360 to 2740 Å are described, and a model of this eclipsing binary system is presented. (auth)

33184 NGC 2345, A MODERATELY YOUNG OPEN CLUSTER IN CANIS MAJOR. Moffat, A. F. J. (Ruhr Univ., Bochum, Ger.). Astron. Astrophys., Suppl. Ser.; 16: No. 1, 33-42(Jul 1974).

Photoelectric UBV and spectroscopic observations yielded for NGC 2345 a distance of 1.75 kpc and earliest spectral type B4 after corrections for variable reddening. The cluster contains seven bright giants, two of rare A type and five of K type. One of the red bright giants has a blue variable companion. (5 figures, 2 tables) (auth)

33185 NGC 3105, A YOUNG VERY DISTANT CLUSTER IN VELA. Moffat, A. F. J. (Ruhr Univ., Bochum, Ger.); Fitzgerald, M. P. Astron. Astrophys., Suppl. Ser.; 16: No. 1, 25-32(Jul 1974).

The following parameters were derived for NGC 3105: distance, 8.0 ± 1.5 kpc; reddening, $E_{B-V} = 1.09 \pm 0.03$; diameter, 5.2 pc; earliest spectral type, b1. Its youth and large distance make it a useful candidate for galactic dynamics. NGC 3105 contains 2 blue and 2 red supergiants, 1 (possibly 2) strong emission B star, and a possible high-luminosity cepheid. (3 figures, 1 table) (auth)

33186 PROPER MOTIONS, CLUSTER MEMBERSHIP, AND REDDENING IN NGC 6611. Kamp, L. W. (Univ. of Chicago). Astron. Astrophys., Suppl. Ser.; 16: No. 1, 1-23(Jul 1974).

Proper motions were derived with a mean error of 0.07 arcsec/100 years for 142 stars brighter than $V = 13.2^m$ in the field of NGC 6611 by using one first-epoch and two second-epoch plates taken on the Yerkes 40" refracting telescope. The probability of cluster membership of each star was computed from the distribution of the proper motions, and yielded 35 members. By using the normal coefficient of selective absorption (0.72 for O stars), a systematic difference of about 0.06^m was observed between derived intrinsic colors (B−V) and those appropriate to the spectral types. This was corrected by deriving a law of selective extinction for this cluster, which yields normal intrinsic colors, and applying this to the cluster members. A ratio of total to selective extinction 3.9 ± 0.2 was derived, and a cluster distance of 1.6 ± 0.2 kpc was obtained. The luminosity calibration for O stars of Walborn (1972) gave a better fit than that of Lesh (1968). There was slight evidence for an extinction−luminosity correlation as proposed by Reddish (1967). The unevolved main sequence was observable from O5 to B5. The cluster age was estimated to be on the order of 5×10^6 years. Several members lay above the main sequence, including five in the giant region. (10 figures, 5 tables) (auth)

33187 NEUTRON STAR MATTER AND NEUTRON STAR MODELS. Heintzmann, H. (Koeln Univ. (F.R. Germany). Inst. fuer Theoretische Physik); Hillebrandt, W.; El Eid, M. F.; Hilf, E. R. (Technische Univ. Darmstadt (F.R. Germany). Inst. fuer Kernphysik). Z. Naturforsch., a; 29: No. 6, 933-946(Jun 1974).

8 figs.; 4 tabs.; 51 refs.

Various methods to study the ground state of neutron star matter are compared and the corresponding neutron star models are contrasted with each other. In the low density region $\rho < 10^{14}$ gr cm^{-3} the nuclear gas is treated here by means of a Thomas Fermi method and the nuclei are described by the droplet model of Myers and Swiatecki. For $\rho > 10^{14}$ gr cm^{-3} both standard Brueckner theory with more realistic interaction (one-boson-exchange) potentials and the semiphenomenological theory of Fermi liquids are applied to neutron star matter. Various tentative (but unreliable) extensions of the equation of state into high density regime $\rho > 10^{15}$ gr cm^{-3} are investigated and it is shown that the mass limit for heavy neutron stars lies around 2.5 solar masses. It is further shown that a third family of stable (hyperon) stars is not forbidden by general relativistic arguments if there is a phase transition at high densities. (auth)

33188 EQUILIBRIUM STRUCTURES OF RELATIVISTIC STAR CLUSTERS. Occhionero, F. (Consiglio Nazionale delle Ricerche, Frascati (Italy). Lab. di Astrofisica Spaziale; Rome Univ. (Italy). Istituto di Matematica); San Martini, A. (Consiglio Nazionale delle Ricerche, Frascati (Italy). Lab. di Astrofisica Spaziale). Astron. Astrophys.; 32: No. 2, 203-208(May 1974).

7 figs.; 1 tab.; 16 refs.

The spherically symmetric equilibrium structures available to a monoenergetic collection of point masses under the influence of their own gravity in extreme relativistic conditions are investigated. The family of solutions, parametrized by R_s/R, the ratio between the Schwarzschild and the coordinate radius (or equivalently by z_c, the central redshift), attains a 3.6% maximum of the fractional binding energy for $R_s/R \approx 0.3$ $z_c \approx 0.5$). Beyond this limit the relativistic cluster is probably dynamically unstable for radial perturbations and therefore uninteresting from an astrophysical point of view. On the contrary, the equilibrium sequence for $0 \lesssim R_s/R \lesssim 0.3$ represents a possible evolutionary track for quasi-static contraction. (auth)

33189 ZVEZDY TIPA RW VOZNICHEGO. (RW Aurigae Type Stars). Tsesevich, V. P.; Dragomiretskaya, B. A. Kiev; Isdatel'stvo Naukova Dumka (1973). 440p.

A collection of 47 tables lists photographic magnitudes and recognized types of variability for 80 RW Aurigae type low luminosity irregular variables as measured on photographic plates mainly from Moscow, Odessa, and Harvard Observatories. The tables are intended to aid in the recognition and definition of features which may be common to or characteristic of these stars in spite of the irregular and aperiodic variations of luminosity. (IAA)

33190 RAPIDLY ROTATING STARS, DISKS, AND BLACK HOLES. Bardeen, J. M. (Yale Univ., New Haven). pp 241, 243, 245-289 of Black Holes. New York; Gordon and Breach, Science Publishers, Inc. (1973).

From proceedings of the twenty-third summer school of theoretical physics; Les Houches, France (1 Aug 1972).

Configurations in which the main support against gravitation is centrifugal force, as opposed to pressure gradient forces, are considered. Rapidly rotating configurations offer an avenue of approach to black holes which is qualitatively different from the much more intensively studied and much better understood approach of spherically symmetric gravitational collapse. The basic equations involved are discussed together with boundary conditions, the angular momentum and mass, the structure of the matter configuration, questions of stability, and uniformly rotating disks. (IAA)

33191 ASTROPHYSICS OF BLACK HOLES. Novikov, I. D. (Inst. of Applied Mathematics, Moscow); Thorne, K. S. pp 343, 345-350 of Black Holes. New York; Gordon and Breach, Science Publishers, Inc. (1973).

From proceedings of the twenty-third summer school of theoretical physics; Les Houches, France (1 Aug 1972).

Aspects of thermal bremsstrahlung are discussed together with free-bound radiation, thermal cyclotron and synchrotron radiation, electron scattering of radiation, hydrodynamics and thermodynamics, radiative transfer, shock waves, and the reconnection of magnetic field lines. The origin of stellar black holes is considered along with black holes in the interstellar medium and black holes in binary star systems and in the nuclei of galaxies. White holes and black holes of cosmological origin are also examined, taking into account the growth of cosmological holes by accretion and the limit on the number of baryons in cosmological holes. (IAA)

33192 DEVELOPMENT OF PHOTOGRAPHIC TECHNIQUES FOR PHOTOMETRY AND POLARIMETRY OF FAINT STARS IN THE R-IR REGION. Treanor, P. J. (Vatican Observatory, Vatican City, Italy). Int. Astron. Union Symp.; No. 52, 153-160 (1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33193 VELOCITY FIELDS IN STELLAR ATMOSPHERES AND THE CONCEPT OF MICROTURBULENCE. Worrall, G.; Wilson, A. M. (Goddard Space Flight Center, Greenbelt, MD). Vistas Astron.; 15: 39-60(1973).

In the line spectrum of a star, the discrepancies between observed and theoretical widths cannot be fully accounted for by Doppler broadening due to thermal motion. Microturbulence was introduced to explain the occurrence of nonthermal broadening of the lines. Based on a layer concept of line formation, microturbulence can be defined as the effect of a small-amplitude oscillatory velocity field on opacity. It is shown that no part of the velocity field which is observed in the solar atmosphere can be responsible for microturbulence. (IAA)

33194 INTERSTELLAR CIRCULAR POLARIZATION OF UPPER SCORPIUS STARS. Kemp, J. C. Int. Astron. Union Symp.; No. 52, 181-185(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33195 EJECTION OF GRAINS FROM COOL STARS. Wickramasinghe, N. C. (University Coll., Cardiff, Wales). Int. Astron. Union Symp.; No. 52, 345-347(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Dust grains expelled from cool stars are injected into interstellar clouds with typical velocities of 1000 km/sec. The interaction of such high-speed grains with gas is discussed. Grains are preferentially stopped within clouds of number density from 10 to 30 per cu cm. Collisions of grains with gas atoms could lead to heating and ionization of clouds and to the production of displacement defects in grains. (auth)

33196 DUST AND STAR FORMATION. McNally, D. (London Univ.). Int. Astron. Union Symp.; No. 52, 549-558(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

The view that dust is essential to star formation is challenged on the ground that other interstellar constituents can provide more rapid cooling. From the evidence of stellar minimum masses it is suggested that self absorption of the radiation emitted by the coolant H_2 is the dominant mechanism leading to the heating of a collapsing fragment. It is however shown that extensive dust and molecule formation may take place during star formation and that a natural explanation for the 4 terrestrial planets in the neighborhood of the sun is then provided. (auth) (IAA)

33197 CRYSTALLIZATION OF SUPERDENSE MATTER. Canuto, V.; Chitre, S. M. (Goddard Space Flight Center, New York). pp 705-730 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33198 ENERGY GAP IN NEUTRON STAR MATTER. Tamagaki, R. (Kyoto Univ.). pp 745-768 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33199 CARBON ISOTOPE RATIO IN ARCTURUS. Griffin, R. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 645-661(Jun 1974).

The C^{12}/C^{13} ratio in Arcturus is shown to be $5\frac{1}{2}$ to 6 by analysis of photographic spectrograms of the red CN(2,0) band. (auth)

33200 PHOTOMETRY OF SOUTHERN GLOBULAR CLUSTERS. III. Bright Stars in 47 Tucanae, NGC6397 and NGC288. Cannon, R. D. (Royal Greenwich Observatory, Hailsham, Eng.). Mon. Notic. Roy. Astron. Soc.;167: No. 3, 551-580(Jun 1974).

New photoelectric UBV data are presented for about 60 stars down to V = 16 in 47 Tuc, 80 stars to V = 16.5 in NGC 6397 and 50 stars to V = 17.5 in NGC 288. The 47 Tuc data agree well with recent work by Menzies, and indicate systematic errors in earlier photographic photometry; the majority of the 47 Tuc horizontal branch stars occupy a very small clearly defined region of the C-M diagram. NGC 6397 has a narrow well defined giant branch, with only a few possible asymptotic branch stars or red horizontal branch stars; there are considerable systematic errors in the earlier RGO photographic photometry. NGC 288 is unusual in having a predominantly blue horizontal branch but apparently high metallicity according to several criteria; its reddening is E(B-V) = 0.04 mag and its apparent distance modulus is (m-M) ≈ 14.5 A comparison is made between these three clusters and two studied previously, ω Cen and NGC 6752, and four northern clusters studied extensively by Sandage. The interstellar reddenings, distances, ultraviolet excesses and other parameters are derived. Various metallicity parameters correlate well together, but several clusters violate the general correlation between metallicity and horizontal branch type by having purely blue horizontal branches irrespective of metallicity. NGC 288 is the most extreme example of this class, of which M13 is the prototype. (auth)

33201 EVOLUTIONARY SCHEME W UMa — CV — TYPE I SN. Warner, B. (Cape Town Univ., Sough Africa). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 61P-64P(Jun 1974).

Considerations of space densities and lifetimes indicate that W UMa stars evolve into cataclysmic variable stars, and that these later turn into one of the two kinds of type I supernovae. It is suggested that the mechanism for the latter evolutionary stage is the transfer of helium from the remnant of the secondary to the primary, resulting in pushing the white dwarf primary over the Chandrasekhar limit. (auth)

33202 PRELIMINARY REPORT ON THE LIGHT VARIATION OF SK. 160 = SMC X-1. Van Genderen, A. M. (Leiden Southern Station, Broederstroom, South Africa). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 57P-59P(Jun 1974).

Photometric observations of the x-ray binary Sk.160 = SMC X-1 are presented. The minima are of equal depth (0.14 mag) and the scatter is partly intrinsic. By matching the present observations with those of Butler and Byrne a period of 3.89267 ± 0.00010 (e.e.) days is found. With this period the x-ray minimum coincides perfectly with one of the minima. Apparently no recent period change has taken place. (auth)

33203 NEW DETERMINATION FROM OB STARS OF THE GALACTIC ROTATION CONSTANTS AND THE DISTANCE TO THE GALACTIC CENTRE. Balona, L. A.; Feast, M. W. (Radcliffe Observatory, Pretoria). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 621-634(Jun 1974).

The overall kinematics of the OB stars was rediscussed using a new calibration of Hγ equivalent widths and MK luminosity classes by Balona and Crampton (Mon.Not.R.astr.Soc.; 166:203 (1974)). As well as published material data were used from new Hγ equivalent width measurements in 590 southern OB stars. The principal results are A = 16.8 km s^{-1} kpc^{-1}, u_0 = + 7.4 km s^{-1} and v_0 = + 13.0 km s^{-1}. A distance, R_0, to the galactic center of 9.0 kpc with a range of about 7.7 to 10.9 kpc is found. This is in satisfactory agreement with the determination of R_0 from the distribution of RR Lyrae variables, especially if the latter is corrected for statistical effects. (auth)

33204 ATMOSPHERIC PROPERTIES OF SHORT-PERIOD CEPHEIDS AND THE NATURE OF THE BEAT CEPHEIDS. Schmidt, E. G. (Royal Greenwich Observatory, Hailsham, Eng.). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 613-620(Jun 1974).

Atmospheric parameters are obtained for three short-period cepheids (TU Cas, SZ Tau and α UMi) from high dispersion spectra. Additionally, for these three stars and three long period cepheids (RX Aur, X Cyg and T Mon) radial velocities are measured for metal lines and for Hα. It is found that the beat cepheid TU Cas does not resemble the other stars as closely as expected indicating that it is not a classical cepheid as had been thought. This resolves the problem of the masses of beat cepheids. It is also concluded that differential velocities in the atmospheres of cepheids do not contribute greatly to the observed microturbulence. (auth)

33205 SPECTROSCOPIC OBSERVATIONS OF EIGHT QSO CANDIDATES AMONG MARKARIAN OBJECTS. Wills, D.; Wills, B. J. (Texas Univ., Austin). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 79P-81P(Jun 1974).

Eight of the ten objects suggested as possible QSOs in Markarian's fourth list of objects with ultraviolet continua were observed spectroscopically; all eight are galactic stars, predominantly DA type white dwarfs. (auth)

33206 PHOTOELECTRIC MEASUREMENTS OF THE SWAN BAND OF C_2 IN SOME G AND K STARS. Alexander, J. B.; Branch, D. (Royal Greenwich Observatory, Hailsham, Eng.). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 539-549(Jun 1974).

Photoelectric measurements with interference filters are used to examine the behavior of C_2 in a variety of G and K stars. Observations indicate that C_2 is enhanced in metal-rich stars and giants. It appears probable that α Ser and μ Leo are appreciably more metal rich than the sun. In some barium stars, there is no evidence for any abnormalities in the carbon abundance. (auth)

33207 RADIO OBSERVATIONS OF THE 'DOUBLE QSO' 4C 11.50. Wills, D.; Cotton, W. D. (Texas Univ., Austin). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 75P-77P(Jun 1974).

The radio source 4C 11.50 is double at 365 and at 2695 MHz; at the latter frequency one component agrees in position with the brighter of the close pair of QSOs studied by Wampler et al (Nature; 246:203(1973)). At 8085 MHz, only one component was observed, and its position again agrees with that of the brighter QSO. An upper limit of 0.05×10^{-26} W m^{-2} Hz^{-1} at 2695 and 8085 MHz can be set to emission from the fainter QSO or from the red galaxy about 10'' arc away from the brighter QSO. (auth)

33208 PHOTOELECTRIC SPECTRUM SCANS AND COUDE SPECTROSCOPY OF HD 153919. Bopp, B. W.; Grupsmith, G. (Texas Univ., Austin). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 65P-68P(Jun 1974).

Photoelectric scanner observations and Coudé spectroscopy of HD 153919 are reported. None of the scans obtained on four nights show any evidence of broad emission wings near 4100 or 4350 Å, as has been previously reported by Walker and Hensberge et al. The Hβ emission is variable in intensity from night to night and perhaps on time scales as short as a few minutes. The Coudé spectra show the C III-N III and He II emission features to have broad (± 40 Å) wings. (auth)

33209 PROSPECTS FOR DETECTING BLACKBODY X RAYS FROM NEUTRON STARS. Greenstein, G.; McClintock, J. E. (Amherst Coll., MA). Science; 185: No. 4150, 487-490(9 Aug 1974).

The discussion covers the reasons for the study of neutron stars, the theoretical and experimental determinations of temperature, and the possibility of experimental observation. (JFP)

33210 STRUCTURE AND APPEARANCE OF ACCRETING DISCS AROUND BLACK HOLES. Cunningham, C. T. Seattle, University of Washington (1973). 123p. University Microfilms Order No. 74-15,510.

Thesis (Ph.D.).

Geometrical optics is used to calculate the appearance of an accreting disc as seen by a distant observer and the flux of the radiation which is reabsorbed on its surface. The reabsorbed radiation increases the amount of flux emitted by the disc and decreases its limb darkening. The reabsorbed radiation also deposits angular momentum, decreasing the viscous stresses in the disc. The stresses vanish and the disc is destroyed at a radius slightly outside the radius of marginal stability. Reabsorption heats the disc and increases the surface pressure, causing changes in the vertical structure, and the disc swells in all but its innermost region. This swelling is negligible inside the "flare radius", typically 10^3 to 10^4 times the gravitational radius of the black hole. Outside that radius the disc swells drastically, and its structure changes radically. It becomes a dense plate surrounded by a large, diffuse envelope. The swollen wings of the disc trap a large fraction of the disc's radiation: 10% for a disc around a supermassive black hole; even more if the hole is of lower mass. As seen from a large distance, the effective luminosity of the disc is nearly independent of the observer's angular position. The observed spectrum of radiation from the inner core of the disc is harder for observers near the plane of the disc and for black holes of large mass. The radiation trapped and reradiated by the wings has the spectrum of the core radiation if the black hole is of low mass, a thermal spectrum if the hole is supermassive. The low frequency spectrum of the disc is produced in the optically-thin outer wings and is independent of frequency. Reabsorption and the cutoff of the stress at small radii have little effect on the evolution of the black hole. The limiting angular momentum of the hole is a = .9983m, considering these effects. (Diss. Abstr. Int., B)

33211 PROPERTIES OF TWO COMMON PHOTOMETRIC SYSTEMS AND PHOTOMETRIC OBSERVATIONS OF SELECTED ECLIPSING BINARY SYSTEMS. Spear, G. G. Philadelphia; University of Pennsylvania (1973). 298p. University Microfilms Order No. 74-14,143.

Thesis (Ph.D.).

An analytical method for describing a photometric system is introduced. If adopted, the method should eliminate some of the difficulties associated with the standardization of photometric observations. Analytical descriptions of extinction by the earth's atmosphere and by the interstellar medium enabled the following conclusions to be reached: atmospheric extinction coefficients for U and the U–B index exhibit appreciable variation with spectral type, and reduced outside-atmosphere values for these parameters are extremely sensitive to the procedures for deriving and applying extinction corrections; color-dependent extinction corrections for uvby photometry may safely be neglected unless the internal photometric precision is consistently better than 0.01 magnitudes; the ratio of total-to-selective extinction and the color excess ratio for the UBV system are dependent both on spectral type and the path length through interstellar material and may therefore introduce systematic errors into intrinsic parameters derived for heavily reddened cool stars. This last effect may mimic UV excesses under certain circumstances. Standard relations are derived for uvbyβ photometry and several methods of removing the effects of interstellar extinction are reviewed and applied to published data. Absolute magnitude calibrations for uvbyβ photometry are also reviewed and an intriguing correlation is found between departures from the calibration and a parameter δ(u−b) for emission line objects in several galactic clusters. uvbyβ observations are presented for nine eclipsing binary systems which reportedly undergo total eclipses. The data are used to derive photometric parameters for individual components which are then compared both with single stars and theoretical models. The binary components are indistinguishable from single stars with the exception of the β index which indicates appreciably weakened Hβ lines for several components. With respect to the models several components appear under luminous and could be interpreted as having an enhanced concentration of heavy elements. (Diss. Abstr. Int., B)

33212 STRUCTURE OF COMPACT RADIO SOURCES AT 10.7 GHz. Shaffer, D. B. Pasadena, CA; California Inst. of Tech. (1974). 106p. University Microfilms Order No. 74-14,285.

Thesis (Ph. D.).

Very long baseline interferometry was used to study the compact structure of seven radio sources at 10,709 MHz (λ = 2.8 cm). The observations, the first of a series were made on April 28 to May 1, 1972, using the NRAO Mark II recording system. Antennas of the Owens Valley Radio Observatory (California), the Harvard Radio Astronomy Station (Texas), and the National Radio Astronomy Observatory (West Virginia) were used to give three baselines that greatly improved the (u,v)-plane coverage compared to the coverage of previously used single baselines. The three baselines had lengths of 119, 84, and 54×10^6 λ. (Diss. Abstr. Int., B)

33213 PERTURBATIONS OF A ROTATING BLACK HOLE. Teukolsky, S. A. Pasadena, CA; California Inst. of Tech. (1974). 143p. University Microfilms Order No. 74-14,289.

Thesis (Ph. D.).

Decoupled, separable equations describing perturbations of a Kerr black hole are derived. These equations can be used to study black hole processes involving scalar, electromagnetic, neutrino or gravitational fields. A number of astrophysical applications are made: Misner's idea that gravitational synchrotron radiation might explain Weber's observations is shown to be untenable; rotating black holes are shown to be stable against small perturbations; energy amplification by "superradiant scattering" of waves off a rotating black hole is computed; the "spin down" (loss of

angular momentum) of a rotating black hole caused by a stationary nonaxisymmetric perturbation is calculated. (Diss. Abstr. Int., B)

33214 COPERNICUS OBSERVATIONS OF VARIATIONS IN THE X-RAY FLUX FROM CYGNUS X-1. Sanford, P. W. (University Coll., London); Mason, K. O.; Hawkins, F. J.; Murdin, P.; Savage, A. Astrophys. J., Lett.; 190: No. 2, L55-L58(1 Jun 1974).

The Mullard Space Science Laboratory x-ray instrumentation on board Copernicus has observed Cyg X-1 for a continuous period of 6.5 days from 1973 November 5 to November 11. A variation in flux level was observed on a time scale of 5.6 days, the period of the optical candidate. The peak of the x-ray flux corresponds to the time of closest approach to the observer of the secondary component of the optical candidate, HDE 226868, as calculated from optical radial-velocity measurements. This observation greatly strengthens the identification of HDE 226868 with the x-ray source. (auth)

33215 INTERPRETATION OF THE He II λ4686 EMISSION LINE IN HDE 226868 (CYGNUS X-1). Bisiacchi, G. F.; Dultzin, D.; Firmani, C.; Hacyan, S. (Univ. Nacional Autonoma de Mexico, Mexico City). Astrophys. J., Lett.; 190: No. 2, L59-L62(1 Jun 1974).

Two models are studied to explain the origin and behavior of the observed He II emission line λ4686 in the binary system 226868 (Cyg X-1). It is shown that observational data can be quantitatively explained if the line is emitted by a jet of matter flowing from the primary to the secondary. This, in turn, permits one to estimate the ratio μ (mass of the unseen secondary/total mass), which turns out to be ~0.3. The possibility that the line is radiated by a disk rotating with Keplerian velocity around the secondary is very unlikely because of the unrealistic value obtained for the mass of the primary. (auth)

33216 34-MICRON OBSERVATIONS OF ETA CARINAE, G333.6 TO 0.2, AND THE GALACTIC CENTER. Sutton, E. (California Inst. of Tech., Pasadena); Becklin, E. E.; Neugebauer, G. Astrophys. J., Lett.; 190: No. 2, L69-L70(1 Jun 1974).

Preliminary 34-μ observations show that the majority of the infrared flux from η Carinae can be attributed to a 250°K circumstellar dust shell, the infrared energy distribution of G333.6−0.2 exhibits a smooth continuum rising to 34 μ, and the central 30″ area of the galactic center is a strong 34-μ emitter with an energy distribution similar to that of G333.6−0.2. (auth)

33217 G240-72: A NEW MAGNETIC WHITE DWARF WITH UNUSUAL POLARIZATION. Angel, J. R. P. (Univ. of Texas, Austin); Hintzen, P.; Strittmatter, P. A.; Martin, P. G. Astrophys. J., Lett.; 190: No. 2, L71-L72(1 Jun 1974).

G240−72 (=LP 44-113), a DC white dwarf, is found to show elliptical polarization. There is no evidence of variability. The circular component, typically 0.5 percent, changes sign with wavelength, being negative in blue light and positive in red. There is a relatively strong component of linear polarization, 1.4 percent in blue light. (auth)

33218 WAVE PROPAGATION IN A RANDOM MEDIUM: A COMPLETE SET OF THE MOMENT EQUATIONS WITH DIFFERENT WAVENUMBERS. Lee, L. C. (California Inst. of Tech., Pasadena). J. Math. Phys. (N. Y.); 15: No. 9, 1431-1435 (Sep 1974).

Propagation of waves in a random medium is studied under the "quasioptics" and the "Markov random process" approximations. Under these assumptions, a Fokker-Planck equation satisfied by the characteristic functional of the random wave field is derived. A complete set of the moment equations with different transverse coordinates and different wave numbers is then obtained from the Fokker-Planck equation of the characteristic functional. The applications of the results to the pulse smearing of the pulsar signal and the frequency correlation function of the wave intensity in interstellar scintillation are briefly discussed. (auth)

33219 EMDEN'S FUNCTIONS FOR POLYTROPES WITH NEGATIVE INDEX. Viala, Y.; Horedt, G. P. (Observatory, Meudon, France). Astron. Astrophys., Suppl. Ser.; 16: No. 2, 173-206(Aug 1974).

The Emden's equation is numerically integrated for plane-parallel, cylindrical, and spherical polytropes with negative index. The polytropic functions are tabulated for 10 values of the polytropic index in the range $-10 < n < -0.2$. (30 tables) (auth)

33220 SPECTRUM OF THE Ap STAR HD 111133. Engin, S. (Ankara Univ.). Astron. Astrophys., Suppl. Ser.; 16: No. 2, 237-267(Aug 1974).

The identification and equivalent widths of the spectral lines present in the spectrum of the Cr−Eu−Sr Ap star HD 111133 are given. These data were used for computing an atmospheric model, and the results of the analysis are published in the main journal. (2 tables) (auth)

33221 PHOTOELECTRIC PHOTOMETRY OF LATE TYPE STARS IN THE DIRECTION OPPOSED TO GALACTIC ROTATION. Grenier, S. (Observatorie de Paris, Meudon, France). Astron. Astrophys., Suppl. Ser.; 16: No. 2, 269-276(Aug 1974).

A star field, mainly composed of G stars, was measured by using UBV photoelectric photometry. These results show good internal accuracy for stars of types F and G. (1 figure, 3 tables) (auth)

33222 NON-SUPERGIANT STARS NEAR MAGELLANIC CLOUDS. Carozzi, N. (Observatoire de Marseille). Astron. Astrophys., Suppl. Ser.; 16: No. 2, 277-287(Aug 1974). (In French).

Seventy-five stars with high radial velocities were found between the Magellanic Clouds and between the Large Magellanic Cloud and the Milky Way. Accurate radial velocities and spectral types were obtained for thirty-one of them: these stars belong to the luminosity class III or V only. (18 figures, 2 tables) (auth)

33223 PHOTOGRAPHIC AND SPECTROSCOPIC OBSERVATIONS OF N AQL 1970, N CYG 1970, AND N SCT 1970. Ciatti, F.; Rosino, L. (Univ., Padua). Astron. Astrophys., Suppl. Ser.; 16: No. 2, 305-322(Aug 1974).

Spectra and magnitudes of three galactic novas that appeared during 1970 in Aquila, Cygnus, and Scutum were obtained in Asiago with the parabolic and Schmidt telescopes. Light curves, epochs of maximum, and color indices was derived. The spectra were characterized at first by the presence of emission lines of moderate excitation, particularly Fe II, accompanied by absorption components with large negative displacements. Later, after the nebular stage was reached, the excitation gradually increased, with the appearance and strengthening of permitted and forbidden lines of high ionization potential (He I, He II, N III, O III, Ne III). The rise of excitation continued in N Sct during 1971−73, when emission lines of [Fe VI], [Fe VII], and [Fe X] emerged and became prominent. In all three novas the emission lines acquired a saddle-type profile, splitting into two components. Identifications and intensity estimates of emission lines are reported. Some general considerations follow. (7 figures, 12 tables) (auth)

33224 SUPPLEMENTARY LIST OF SOUTHERN O STARS. Thackeray, A. D.; Andrews, P. J. (Radcliffe Observatory, Pretoria). Astron. Astrophys., Suppl. Ser.; 16: No. 2, 323-327(Aug 1974).

Thirty-two southern O stars that do not appear in Goy's general catalogue are listed. UBV photometry is presented for some of these stars and of some others in the Goy catalogue. The heaviest concentrations of O stars occur in Carina−Centaurus, Norma, and Cygnus. Known southern O stars in the "inner region" ($l = 270-0-90$) form as much as 63% of the total. (1 figure, 2 tables) (auth)

33225 PHOTOMETRIC STUDY OF THE OPEN CLUSTER M6 (NGC 6405). Vleeming, G. (Univ. of Amsterdam). Astron. Astrophys., Suppl. Ser.; 16: No. 2, 331-342(Aug 1974).

UBV photographic photometry of the open cluster M6 was carried out based on a combined photoelectric sequence of Rohlfs et al. (1958) and Eggen (1960). In the present study attention was paid to the influence of field stars. The following results were obtained: the color-excess, $E_{B-V} = 0.15$m; the true distance modulus $(V-M_v)_0 = 8.3$m ± 0.2m; the distance, 450 ± 50 pc; and the age $\approx 1.0 \times 10^8$ yr. From these data it was concluded that the open cluster M6 is an interarm object lying between the local and Sagittarius arms. (auth)

33226 PROGRESSIVE WAYS IN A STAR CONSTRUCTED ON THE GENERALIZED ROCHE MODEL. III. Series Development of Eigen Function. Moussiaux, A.; Ronveaux, A. (Univ. of Namur, Belgium). Bull. Soc. Roy. Sci. Liege; 43: No. 3-4, 214-222(1974). (In French).

The purpose of this study is to obtain the solution for progressive wave propagation in the Roche model in the form of a series expansion of proper functions. The initial conditions necessary for the determination of the coefficients of the expansion come from previously established results. (JFP)

33227 NUMERICAL ANALYSIS OF STELLAR ROTATION. Delcroix, A. (Univ., Mons, Belgium). Bull. Soc. Roy. Sci. Liege; 43: No. 3-4, 223-248(1974). (In French).

A new numerical method for integration of the intensity in rotating stars is presented. A Gauss Legendre division of the stellar disk is used to perform the double integration giving the flux. It is shown how it is possible to dramatically reduce the number of points needed in the procedure by carefully choosing the subdivisions of the integration intervals; the results show good

agreement with the method used by Underhill who needed a much higher number of points. Finally, the equivalent width of lines is obtained by use of a Roemberg integration scheme. (auth)

33228 STELLAR WINDS AND RELATED PHENOMENA IN SURROUNDING NEBULAE. Pikel'ner, S. B. (State Astronomical Inst., Moscow). Comments Astrophys. Space Phys.; 5: No. 6, 151-158(1973).

The structure of the stellar wind interaction with surrounding nebulae is considered. (JFP)

33229 RADIATION PRESSURE AND THE LITHIUM-BERYLLIUM PROBLEM. Schatzman, E.; Vauclair, S. (Observatoire de Meudon, France). Comments Astrophys. Space Phys.; 5: No. 6, 159-167(1973).

The discussion of radiation pressure effects on the abundance of lithium, beryllium, and boron in the outer layers of stars covers competitive processes, 3 Cen A, indications of turbulent transport, lithium, beryllium, boron, and the star sequence. (JFP)

33230 STATISTICAL ANALYSIS OF BRIGHTNESS OF AK Sco. Kondratyuk, R. R. (Main Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 21, 97-98(1974). (In Russian).

The distribution and autocorrelative functions of light changes of AK Sco are obtained from a large series of visual observations. The process of light variations consists of two pure stochastic components as well as of two harmonic stochastic components with periods 14 and 220 days and much smaller dispersions. (auth)

33231 ANALYSIS OF BRIGHTNESS OF THREE RAPID IRREGULAR VARIABLE STARS. Lukatskaya, F. I. (Main Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 21, 93-96(1974). (In Russian).

The results of analysis of distribution and autocorrelative functions of visual brightness during 1963 to 1970 are given for S CrA, RU Lup and RY Lup. The statistical characteristics of brightness variation processes in 1952 to 1953, 1959, and 1963 to 1970 are compared for RU Lup and RY Lup. (auth)

33232 W URSAE MAJORIS: MASS-RATIO DISCREPANCY, THIRD BODY AND AGE. Whelan, J.; Mochnacki, S. W.; Worden, S. P. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 31-40(Jul 1974).

The discrepancy between the spectroscopically and photometrically determined mass-ratios of W Ursae Majoris, and the observed quasi-sinusoidal period variations may be understood if there is a third body in the system which contributes about 4 per cent of the light at maximum. The third body has a mass of about 0.2 $M_\odot$ and could be a Hayashi star. The time scale for its contraction to the main-sequence (5×10^8 yr) is of the same order as an estimate of the age of W Ursae Majoris (1 to 5×10^8 yr) deduced from the time since coincidence of W Ursae Majoris and its proper motion companion BD + 55° 1351. The inferred age of W Ursae Majoris may be significant for contact binary evolution theory. Several observational tests of the third-body hypothesis are proposed. The possibility that the period changes are caused by mass exchange, mass loss or aspidal motion cannot be ruled out and these mechanisms are compared with the third-body hypothesis. (auth)

33233 MAGNETIC STARS WITH A SLOW MERIDIONAL CIRCULATION. Moss, D. L. (Univ. of Manchester, Eng.). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 61-72(Jul 1974).

A first-order perturbation theory method is presented for calculating the steady-state meridional circulation in a rotating star with a large scale poloidal magnetic field. The Legendre series for the velocity and magnetic fields are truncated after the P4 terms. The solutions found have velocities which tend rapidly to zero near the stellar surface and are only small perturbations on the zero circulation solutions previously calculated. Attempts to find solutions which were not just small perturbations on the zero circulation solutions were unsuccessful. (auth)

33234 SITE OF THE HELIUM FLASH REVISITED. Owen, P. R. (Royal Military Coll. of Science, Shrivenham, Eng.). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 53-54(Jul 1974).

In the light of a substantially revised reaction rate, the conclusion of an earlier paper (Owen, Mon. Not. R. Astr. Soc.; 154: 59 (1971)), that nitrogen burning can affect the site of the helium flash is shown to be incorrect. (auth)

33235 INFRARED OBSERVATIONS OF NORTHERN EMISSION-LINE STARS. Allen, D. A. (Kitt Peak National Observatory, Tucson, AZ). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 1-13(Jul 1974).

One hundred and forty-two stellar planetary nebulae and a few other emission-line stars of the northern galactic plane have been examined in the infrared. Twenty-nine of these, including the peculiar variable star HBV 475, are shown to have late-type stellar components. Some previously unreported instances of large infrared excesses are also presented. Spectra of some of the infrared sources are briefly described. Extinction in the 3.2 μm ice band has been found in the spectrum of MWC 349; this supports its suspected membership of Cyg OB2. Three planetary nebulae thought to be stellar have been found to be extended. (auth)

33236 EVOLUTION OF THE WOLF-RAYET FEATURES OF THE SLOW NOVA, RB TELESCOPII. Thackeray, A. D.; Webster, B. L. (Radcliffe Observatory, Pretoria). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 101-107(Jul 1974).

Between 1951 and 1960, the spectrum of RR Telescopii contained broad emission bands similar to those in Wolf-Rayet stars, as well as a narrow nebular-line spectrum. As the nebular spectrum increased in ionization level, the equivalent Wolf-Rayet type of the bands varied from WN 6 to WN 3 or earlier and the bands became broader. The possible spectroscopic appearance of extremely high temperature Wolf-Rayet stars is described. It is suggested that the bands arose in the extended atmosphere of the nova remnant, which photoionized the outer nebula and supplied it with kinetic energy through mass loss. The remnant was rapidly contracting and increasing in temperature in the process of recovering from the nova outburst. (auth)

33237 ATTEMPT TO DETECT A CORONA AROUND β ORIONIS WITH AN INTENSITY INTERFEROMETER USING LINEARLY POLARIZED LIGHT. Brown, R. H.; Davis, J.; Allen, L. R. (Univ. of Sydney). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 93-100(Jul 1974).

Observations of the hot supergiant β Orionis have been made with the stellar intensity interferometer at Narrabri using linearly polarized light. The normalized correlation was measured at two baselines with light polarized parallel and perpendicular to the baseline and the results are used to derive two independent measures of the angular size of the star. No significant change of correlation or angular diameter with polarization was observed. A theoretical analysis is given of the effects of electron scattering on measurements in linearly polarized light. Two cases are considered, scattering by electrons in the photosphere and scattering by electrons in an extended corona. The results are compared with the observations of β Orionis and are used to set an upper limit to the mass loss. It is suggested that with a more sensitive interferometer, using linear polarization, it might be possible to detect coronae and other circumstellar matter around some types of stars. (auth)

33238 LINE STATISTICS IN THE Fe I SPECTRUM. Allen, C. W. (Mount Stromlo Observatory, Canberra, Australia). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 121-136(Jul 1974).

The lines of the Fe I spectrum have been counted into suitable ranges of frequency, excitation potential, weighted oscillator strength, and line intensity. At each stage the counts have been compared with corresponding derived values obtained by the methods of statistical spectroscopy. The comparisons have suggested certain amendments to the atomic constants used for deriving the statistics but have shown the formulation to be appropriate. A small correction is proposed for earlier tables of line numbers to be expected in stellar spectra. No very definite conclusions could be reached on numbers of lines that are too faint yet to be observed. (auth)

33239 OBSERVATIONS OF RAPID BLUE VARIABLES. XIV. Z Chamaeleontis. Warner, B. (Cape Town Univ.). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 235-247(Jul 1974).

Z Cha is a dwarf nova and an eclipsing binary with a period of 107 min. High speed photometric observations have been made both at normal light and during outburst. The observations at normal light lead to a model for the system in which the bright spot is abnormally situated. Non-synchronous rotation of the secondary may account for this. The eclipse, which is total, shows the disappearance of both the white dwarf primary and the bright spot. During outburst the eclipses get wider and become partial. These observations clearly establish that the outburst is centered on the primary. The eclipses at maximum light show that the whole disc around the primary is bright. It is suggested that the disc is heated by a thermal pulse or shock wave originating in the outbursting white dwarf. A simple model for the subsequent cooling of the disc leads to a disc mass of 10^{-5} $M_\odot$. Oscillations in the light curve with a period of 27.67 s were present during outburst. (auth)

33240 RADIAL VELOCITY OF 10 LACERTAE IN THE YEAR 1972. Chochol, D. (Astronomical Inst., Skalnate Pleso, Czech.); Grygar, J. Bull. Astron. Inst. Czech.; 25: No. 4, 231-235(1974).

Twenty-four spectrograms of 10 Lacertae were obtained between August 13 and October 27, 1972. The radial velocity in this period was constant, $v_r = (-9.2 \pm 0.2)$ km/s (p.e.), and very close

to the Catalog value. The changes of the strengths of some O II lines, first reported by Underhill and van Helden (1966), were confirmed. (auth)

33241 EVOLUTION OF CLOSE BINARIES. IX. AX Monocerotis as a Binary Undergoing Rapid Mass Exchange of Case B. Harmanec, P. (Astronomical Inst., Ondrejov, Czech.). Bull. Astron. Inst. Czech.; 25: No. 4, 236-246(1974).

Model computations for a case B mass exchange in a system of $7m_\odot + 4.524m_\odot$ are presented in an attempt to explain the present evolutionary stage of the binary AX Mon (HD 45910). At the very beginning of the mass exchange the mass-losing component has a deep outer convective envelope and the process of mass exchange leads to the dynamical instability of this envelope. A simple procedure is described that allows for the computations to be executed properly even in this case. The post-mass-exchange evolution of the mass-losing component was computed up to the moment when the thermal instability occurs in the helium-burning shell. It is noticeable that during this evolution the star remains in the red-giant region of the H-R diagram and does not contract to the neighborhood of the helium main sequence, as was invariably the case in all previous computations of this type. The properties of the AX Mon system seem to be well reproduced by the model presented here. It speaks in favor of the hypothesis that a direct evolutionary connection may exist between the recurrent nova T CrB and shell stars like AX Mon. (auth)

33242 SIGNIFICANCE OF THE CHERENKOV PROCESS IN QUASI-STELLAR OBJECTS. Colvin, J. D. (New Mexico Inst. of Mining and Tech., Socorro). Astrophys. J.; 190: No. 3, 515-519(15 Jun 1974).

A two-stage model for the optical flux from quasi-stellar objects is considered. It is shown that a very high energy density of photons near the electron plasma frequency is produced by the Cherenkov process when an assumed distribution of ultra-relativistic electrons produced in an explosive event passes through a small ($R < 10^{14}$ cm), moderately dense ($N_e \simeq 10^8$ cm^{-3}), magnetized source region. These photons serve as the ambient radiation field for the inverse Compton process to work; i.e., those low energy photons are elevated to optical frequencies by the lower energy relativistic electrons in the initial distribution. The total optical power generated in this two-stage process is shown to be $L_{total} \simeq 1.6 \times 10^{73}/R^2$ ergs s^{-1}, where R is the radius of the source region in centimeters. This model does not require the very high magnetic field required in some other models, including those based on the synchrotron mechanism, but it does require a very small source region, $R < 10^{14}$ cm. Some observational tests pertinent to this model are also discussed. (auth)

33243 INTERFEROMETRIC OBSERVATIONS AT MOUNT PALOMAR. Labeyrie, A. (Observatoire de Paris, Meudon, France). Nouv. Rev. Opt.; 5: No. 3, 141-151(May 1974). (In French).

Speckle interferometry has originated as an extension of methods previously used by Fizeau, Michelson and Pease for observing stellar details in the presence of atmospheric seeing. The fine structure of stellar images long reported by some observers of double stars is in fact a speckle pattern similar to that observable in diffused laser beams. As could be predicted from this interpretation, 1000 speckles were found in the image given by the 5-meter Palomar telescope when observing in monochromatic light with short exposures. The fringes observed by Michelson and Pease, using a Fizeau screen on the aperture, are a special case of speckle which can be analyzed visually because of its simpler structure. The convolution of the speckles with details of the stellar object may be detected by time-averaging the autocorrelation function (or the power spectrum) of the instantaneous image, giving the autocorrelation function (or the power spectrum) of the object. Observations were carried out using a television sensor and optical processing techniques. The diameters of several supergiant stars were measured, and limb darkening was seen in α Orionis and o Ceti. A dozen stars were found to be binary, including Algol, of which the predicted third body is thus exhibited. (FR)

33244 CONTRACTING ENVELOPES OF NOVAE AFTER OUTBURSTS. Nariai, K. (Tokyo Univ., Mitaka, Japan). Publ. Astron. Soc. Jap.; 26: No. 1, 57-64(Mar 1974).

The evolution of a star with an envelope of a very small fraction of the mass and with an insulated hard core is studied. The luminosity is almost constant until the time τ becomes κ Menv/ 8πcRcore, while the effective temperature rises as the radius decreases. Then, both the luminosity and the effective temperature decrease. If we take a white dwarf as the core, we obtain a model of a nova. The visual magnitude decreases from a little after the explosion due to the increase in the bolometric correction, although the bolometric magnitude is almost constant in the early phases. (auth)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstracts 33187, 33363, and 33380.

33245 X-RAY HEATING IN HZ HER. Strittmatter, P. A. (Arizona Univ., Tucson (USA). Steward Observatory; Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (F.R. Germany)). Astron. Astrophys.; 32: No. 1, 7-12(Apr 1974).

2 figs.; 24 refs.

The problem of x-ray heating of a stellar atmosphere is treated using a double grey body approximation and the results are applied to HZ Her. The predicted temperature stratification is shown to be in conflict with the observed optical spectrum of HZ Her if heating is accomplished primarily by postulated but unobservable soft x-rays. The same high opacity which, in the interstellar gas, precludes direct observation at these energies, likewise causes strong absorption in the upper layers of the stellar atmosphere. This causes significant distortion of the temperature stratification and hence results in the formation of emission lines or in marked veiling of the absorption spectrum. The observations are, however, entirely consistent with heating by the observed hard x-rays which penetrate below the photospheric level. The energy dependence of the hard x-ray albedo R is calculated for Population I composition and is shown to have a broad maximum $R \sim 0.6$ in the neighborhood of 25 keV. (auth)

33246 NEUTRON STARS IN SUPERNOVA REMNANTS. Amnuel, P. R.; Guseinov, O. H. (AN Azerbajdzhanskoi SSR, Baku. Shemakhinskaya Astrofizicheskaya Observatoriya). Astron. Astrophys.; 31: No. 1, 37-40(Feb 1974).

1 fig.; 2 tabs.; 25 refs.

Data on supernova remnants is analyzed in view of a search for black holes. For the remnant synchrotron radiation to be maintained, the magnetic field in the remnant should change as $\sim R^{-1.2-1.5}$. Continuous injection of relativistic particles is shown to be necessary. The energetics of the remnants, the increase of magnetic flux, and data about the directions of the magnetic fields are discussed with the assumption that, in each remnant, there is a neutron star (pulsar). The remnants with black holes do not radiate in the radio. The search for black holes is more promising for binary systems. (auth)

33247 NON-LINEAR COMPTON MAGNETO-BREMSSTRAHLUNG. Stewart, P. (Manchester Univ. (UK). Dept. of Mathematics). Astron. Astrophys.; 32: No. 1, 13-15(Apr 1974).

10 refs.

The spectrum radiated by a charged cloud is calculated for the case of a pulse of intense circularly polarized electromagnetic radiation which is switched on adiabatically and which propagates parallel to a magnetostatic field; the cloud is initially at rest. It is shown that in the case where the non-relativistic ion gyrofrequency is much greater than the frequency of the intense wave, ions and electrons radiate equal powers at identical frequencies. The results are applied to the Crab nebula. (auth)

33248 RADIATION REACTION IN NON-LINEAR COMPTON EFFECT. Bonometto, S. (Istituto Nazionale di Fisica Nucleare, Padua (Italy); Padua Univ. (Italy). Istituto di Fisica); Scrascia, L. (Padua Univ. (Italy). Istituto di Fisica). Astron. Astrophys.; 32: No. 1, 115-116(Apr 1974).

5 refs.

It is shown that quantum effects cannot be disregarded in setting the condition to neglect radiation reaction effects in non-linear Compton scattering on electrons, and it is found that the same condition must hold in order to neglect both quantum and radiation reaction effects. (auth)

33249 408 MHz FAN-BEAM SURVEY AT LOW GALACTIC LATITUDES. I. The Observations and a Catalog of Small Diameter Sources. Fanti, C. (Consiglio Nazionale delle Richerche, Bologna); Felli, M.; Ficarra, A.; Salter, C. J.; Tofani, G.; Tomasi, P. Astron. Astrophys., Suppl. Ser.; 16: No. 1, 43-61(Jul 1974).

By using the east–west arm of the Bologna Northern Cross radio telescope, fully sampled observations were made of an extensive region at low Galactic latitudes. The Galactic longitude range was $15° \leq l \leq 245°$, with a latitude coverage of at least 7° at each longitude. The observations, their analysis, and the calibrations and errors of the survey are fully discussed. A catalog is given of 586 small-diameter radio sources with measured flux densities above 1.2×10^{-26} W m^{-2} Hz^{-1}. (3 figures, 3 tables) (auth)

33250 ON THE REDSHIFTS OF QUASARS. Abramenko, B. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Frankfurt am Main (F. R. Germany). Rechenzentrum). Astron. Astrophys.; 31: No. 1, 109-110(Feb 1974).

2 figs.; 2 tabs.; 5 refs.

The notion that the large redshifts of quasars are entirely cosmological is criticized. It is shown that the Hubble diagram of Bahcall and Hills is consistent with a part of the redshift being intrinsic to quasars. (auth)

33251 ENERGETICS OF REISSNER NORDSTROM GEOMETRIES. Denardo, G. (Univ., Trieste, Italy); Ruffini, R. pp R33-R44 of Black Holes. New York; Gordon and Breach, Science Publishers, Inc. (1973).

From proceedings of the twenty-third summer school of theoretical physics; Les Houches, France (1 Aug 1972).

33252 ELECTROMAGNETIC PROCESSES IN THE ATMOSPHERE OF PULSARS. Yukhimuk, A. K. Kosm. Issled. Ukr.; No. 3, 30-36(1973). (In Russian).

The fine structure of radio pulses was studied. On the basis of the kinetic theory, processes occurring in the plasma cloud of a pulsar in the presence of external electromagnetic radiation were studied. The electromagnetic waves caused a drift in the electrons relative to the ions, activating prolonged oscillations. Dispersion equations were obtained describing prolonged oscillations in a magnetic plasma. Conditions were found for oscillation activation. Correlation functions were calculated for electron density and coefficients of dispersion of electromagnetic waves. Variations in the pulse amplitude of pulsars were shown to be related to twinkling due to fluctuations in electron density of the plasma. A mechanism is presented for the radiowaves of pulsars. A model of revolving and pulsating stars is considered, which is a neutron star with a dipole or more complex magnetic field. In the pulsating magnetic field, charged particles are accelerated. These accelerated particles lead to formation of radiation bands. Particles from the radiation bands, at the time of pulsation, go to the prepolar regions because of an upset in the adiabatic invariant. Electromagnetic waves result from rotating relativistic electrons on curvilinear trajectories, which are identified with strong lines from the magnetic poles of the pulsar. (tr-auth)

33253 RADIO POLARIZATION OF QUASARS. Conway, R. G.; Haves, P.; Kronberg, P. P.; Stannard, D.; Vallee, J. P.; Wardle, J. F. C. (Nuffield Radio Astronomy Labs., Jodrell Bank, Eng.). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 137-162(Jul 1974).

Observations over a wide range of wavelengths, $2.2 \leq \lambda \leq 73$ cm, have been combined to define the wavelength variation of the degree of linear polarization, $m(\lambda)$, for 120 quasars with known redshift. For the majority, $m(\lambda)$ decreases monotonically with increasing wavelength but for 35 sources the polarization curve is inverted at short wavelengths. A classification is given, based on both the polarization curve and the radio spectrum, and the results are interpreted in terms of the presence or absence of opaque components in the source. The depolarization which occurs at long wavelengths is accounted for by a combination of spectral effects and Faraday depolarization. For 46 steep-spectrum sources the polarization curve appears to be dominated by the Faraday effect, and has been used to deduce the electron density within the radiating components. In this group of sources the correlation between depolarization and redshift noted by Kronberg et al. (1972) is confirmed and strengthened. A discussion is given of some theoretical models of radio sources in the light of the polarization data. (auth)

33254 X-RAY OBSERVATIONS OF THE COMA AND VIRGO CLUSTERS FROM COPERNICUS. Griffiths, R. E.; Peacock, A.; Davison, P. J. N.; Rosenberg, F.; Smart, N. C. (Univ. of Leicester, Eng.). Nature (London); 250: No. 5466, 471-472(9 Aug 1974).

Observations are reported which were made to determine the spatial characteristics of these sources. The observations were made in January 1973 using the two grazing incidence reflecting telescopes and the collimated proportional counters on the satellite Copernicus. The two telescopes covered the energy ranges 1.5 to 4.6 keV and 0.48 to 1.45 keV, and the counters the range 2.5 to 7.5 keV. Details are given of the observed x-ray fluxes, and these are compared with some earlier observations. Estimates were also made of the core radii. Thermal models are also discussed. The Copernicus observations were consistent with proposed high temperature isothermal gas sphere models. There were no indications of a strong galactic x-ray source at the center of either cluster. (UK)

33255 RADIO AND OPTICAL STUDIES OF 4C 11.50. Argue, A. N.; Ekers, R. D.; Fanaroff, B. L.; Hazard, C.; Ryle, M.; Shakeshaft, J. R.; Stockton, A.; Webster, A. S. (Cambridge Univ., Eng.). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 1P-6P(Jul 1974).

A 5 GHz map of 4C 11.50 with the 5-km telescope reveals a compact component coincident with the QSO 1548 + 115a, together with two extended components; their radio spectra are determined. A low upper limit is placed on radio emission from the nearby QSO 1548 + 115b and there is no evidence of any connection between the two QSOs. A photograph with the 224-cm telescope on Mauna Kea shows a small group of galaxies which may be members of a cluster at the same distance as the brighter QSO. (auth)

33256 PREDICTION OF RADIO STRUCTURE IN THE TWO LARGEST REDSHIFTS QSOs. Jones, T. W.; O'Dell, S. L. (Univ. of California, La Jolla, San Diego). Nature (London); 250: No. 5466, 472-474(9 Aug 1974).

It is stated that the discovery that the optical objects identified with OH 471 (0642 + 449) and OQ 172 (1442 + 101) are QSOs with red shifts of 3.40 and 3.53 has stimulated interest in their optical and radio properties. Angular sizes for the radio sources are predicted based on the incoherent electron synchroton emission. Radio spectral data are given, with decomposition of the spectra into self-absorbed synchrotron components, assuming that all components of a given source have the same spectral index, and theoretically expected angular radii are shown tabulated derived from maximum brightness temperatures; variability time scales are also given. The observations do not firmly establish the existence of variability in either source, although other workers have suggested the possibility of a 20% decrease for OH 471 at 1.4 GHz during a 4 year space. The application of various models is discussed. (UK)

Solar Phenomena

Refer also to abstracts 33152 and 33426.

33257 (AD-772734) INFLUENCE OF CORONAL AND INTERPLANETARY PHENOMENA ON LOW ENERGY SOLAR CHARGED PARTICLE EVENTS. Gold, R. E.; Mitchell, D. G.; Nolte, J. T.; Reinhard, R.; Roelof, E. C. (New Hampshire Univ., Durham (USA). Dept. of Physics). 1 Oct 1973. Contract F19628-73-C-0070. 115p. (AFCRL-TR-73-659). NTIS $4.50.

Low energy solar charged particles (LESP) and interplanetary plasma and magnetic field observations during 1967 have been analyzed and the results have been related to solar coronal structure. The coronal connection longitude was calculated assuming instantaneous Archimedes spirals, and the injection profile was compared with coronal neutral line structure inferred from H alpha synoptic charts. It was found that LESP (0.3-100 MeV) undergo organized transport in the solar corona and "collimated convection" in interplanetary space. LESP tend to be confined to coronal magnetic polarity cells although the release cell may not be associated with the active region in which the LESP were accelerated. Evidence supporting extended acceleration of LESP has been found in several events. (auth)

33258 (AD-775557) GREEN CORONA AND SOLAR SECTOR STRUCTURE. Antonucci, E.; Svalgaard, L. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Feb 1974. Contract N00014-67-A-0112-0068. 17p. (SU-IPR-561). NTIS $3.00.

Analysis of the green line corona for the interval 1947-1970 suggests the existence of large-scale organization of the emission. The green line emission at high northern latitudes (about 40 degrees to 60 degrees) is correlated with the emission at high southern latitudes 6, 15, and 24 days later, while the low latitude green corona seems to be correlated on both sides of the equator with no time lag. These coronal features are recurrent with a 27 day period at all latitudes between plus or minus 60 degrees, and we associate these large-scale structures with the solar magnetic sector structure. The high correlation between northern and southern high-latitude emission at 15 days time lag is explained as a signature of a two-sector structure, while four sectors are associated with the 6 and 24 day peaks. (auth)

33259 (AD-777169) CORONAL X-SPECTRUM: PROBLEMS AND PROSPECTS. Walker, A. B. C. Jr. (Aerospace Corp., El Segundo, Calif. (USA)). 20 Mar 1974. Contract F04701-73-C-0074. 112p. (SAMSO-TR-74-69). NTIS $4.50.

The advent of rocket and satelite borne euv and x-ray spectrometers has resulted in a study of the permitted lines of the highly ionized ion in the solar corona and transition region. Models of the coronal temperature and density structure and of coronal abundances have been developed from these observations. However, spectroscopic studies with high spatial resolution are rare, and substantial progress in the study of coronal structure and of the coronal energy balance will require the development of true euv and x-ray spectroheliographs. (auth)

33260 (AD-777211) X-RAY EMISSION FROM SOLAR FLARES AND ACTIVE REGIONS. Final Scientific Report. Gajewski, R. (American Science and Engineering, Inc., Cambridge, Mass.). 15 Jan 1974. Contract F44620-71-C-0019. 13p. (ASE-3442; AFOSR-TR-74-0466). NTIS $3.00.

The research conducted under this contract is summarized. Work in the following general areas is described: (1) calculations of the x-ray emission from a hot plasma; (2) effect on the x-ray spectrum of departure from steady-state ionization conditions during solar flares; (3) cooling mechanisms operating in solar flare plasma; (4) heating of active regions by magnetic energy dissipation; (5) the nature of plasma arcs in solar active regions; and, (6) a model for magnetic field annihilation. (auth)

33261 (AD-777813) RELATIVE CORONAL ABUNDANCES DERIVED FROM X-RAY OBSERVATIONS OF NITROGEN, OXYGEN NEON, MAGNESIUM, AND IRON. Report for July 1969–December 1973. Walker, A. B. C. Jr.; Rugge, H. R.; Weiss, K. (Aerospace Corp., El Segundo, Calif. (USA)). 29 Mar 1974. Contract F04701-73-C-0074. 42p. (SAMSO-TR-74-80). NTIS $3.25.

The coronal spectrum between 8.5 and 25 A was observed with the crystal spectrometer on the OVI-10 satellite. The measured fluxes of the resonance lines of O VII, O VIII, Ne IX, Ne X, and Mg XI have been used to construct a model of the coronal emission measure between 1 and 6 million K. This model has been used to determine the relative abundances of O, Ne, and Mg. The relative abundances of N and Fe were also computed, using the observed intensities of the resonance lines of N VII and Fe XVII. The coronal model based on the line fluxes was used to calculate the expected continuum fluxes, and these calculated fluxes with the observed continuum fluxes were compared. (GRA)

33262 (AD-778088) PHYSICAL MECHANISM FOR THE PRODUCTION OF SPOT RELATED SOLAR PROMINENCES. White, M. L. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). 18 Jan 1974. 27p. (AFCRL-TR-74-0043; AFCRL-PSRP-584). NTIS $3.25.

It is shown that a charge separation electric field (produced by the interaction of evershed flow with the spot magnetic field) can drive electrical currents upward along magnetic lines that link the photosphere with the upper solar atmosphere. The form and dynamics of the typical two-ribbon flare and their relation to spot related prominences are also considered. (GRA)

33263 (ANCR-1172) DETECTION OF SOLAR NEUTRINOS. Brugger, R. M. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Aug 1974. Contract AT(10-1)-1375. 9p. Dep. NTIS $4.00.

An experiment is suggested by which the gentle interaction of neutrinos with nuclei might be detected. The experiment is to record the temperature of selected volumes of the earth or the moon to observe changes as a function of the solar year in the heat generation rate caused by the oscillating neutrino flux from the sun striking the earth and moon. (auth)

33264 (ITA-39) ELEMENTAL ABUNDANCES, ISOTOPE RATIOS AND MOLECULAR COMPOUNDS IN THE SOLAR ATMOSPHERE. Engvold, O.; Hauge, Oe. (Oslo Univ. (Norway). Institutt for Teoretisk Astrofysikk). 1974. 27p. Dep. NTIS (US Sales Only) $4.50.

Solar abundances of chemical elements and solar isotope ratios are tabulated. The solar abundances of 67 elements are known. In addition, the upper limits for the abundances of 5 elements are listed. Isotope ratio investigations have been carried out for 16 elements. A separate list presents 21 molecules which have been identified in the solar atmosphere and another 15 which may be termed "possibly found". (auth)

33265 (N-74-18336) ENERGETIC PARTICLE FLUX EXPERIMENT (IMP F AND G). Final Report, 28 January 1965–30 June 1971. Anderson, K. A. (California Univ., Berkeley (USA). Space Sciences Lab.). Apr 1973. 13p. (NASA-CR-132869). NTIS $4.00.

The data reduction procedures and programs for analysis of the IMP F and G energetic particle flux experiments are summarized. The IMP-f experiment contained two thin-window Geiger–Mueller detectors and an ionization chamber. There were two IMP-G experiments: one with six Geiger–Mueller detectors and an ionization chamber, and the other with two funnel mouthed channeltrons in a parallel plate electrostatic analyzer. These experiments measured particles in the energy range above 20 keV (IMP-F) and above approximately 5 keV (IMP-G). A bibliography is presented of papers containing the scientific results. These data were predominantly used for the study of low energy solar particles from flares. (auth)

33266 (N-74-18423) LUNAR SURFACE COSMIC RAY EXPERIMENT. Final Report. Price, P. B. (California Univ., Berkeley (USA). Space Sciences Lab.). 7 Feb 1974. 26p. (NASA-CR-134196). NTIS $4.50.

The galactic cosmic ray and solar flare experiment on Apollo 16 is reported. The published papers presented describe the experiment, equipment, data processing techniques, and operational history. The principal findings include: (1) The composition of heavy ions in interplanetary space at energies between approximately 30 and 130 MeV/nucleon is the same, within experimental errors. (2) The ability of a Lexan stack to determine simultaneously the energy spectra of major elements from He up to Fe in the energy interval 0.2 to 30 MeV/nucleon revealed systematic changes in the composition of solar flare particles as a function of energy. (3) Heavy ions emitted in a solar flare appear to be completely stripped of electrons, and are not in charge equilibrium at the time of acceleration and releases from the sun. (STAR)

33267 (N-74-20458) GENERATION OF NUCLEI OF COSMIC RAYS OF SOLAR ORIGIN. Konyakhina, S. S.; Kurnosova, L. V.; Logachev, V. I.; Razorenov, L. A.; Sinitsina, V. G.; Fradkin, M. I. Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 35: No. 12, 2446-2447(1971). 7p. (NASA-TT-F-14773). NTIS $4.00.

A brief treatment is presented of some observations of solar activity and heavy nuclei believed to be of solar origin and observed during the flights of the Elektron series satellites. There is some discussion of the possibility that the two previously mentioned phenomena are coincidental and an example arguing in favor of the opposite view that there is no particular basis for linking the two. (auth)

33268 (N-74-20459) SOLAR WIND DATA FROM THE MIT PLASMA EXPERIMENTS ON PIONEER 6 AND PIONEER 7. Lazarus, A. J.; Heinemann, M. A.; McKinnis, R. W.; Bridge, H. S. (Massachusetts Inst. of Tech., Cambridge (USA); National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Jun 1973. Contract NAS2-3793. 415p. (NASA-TM-X-69991; NSSDC-73-08). NTIS $23.75.

Hourly averages are presented of solar wind proton parameters obtained from experiments on the Pioneer 6 and Pioneer 7 spacecraft during the period December 16, 1965 to August 1971. The number of data points available on a given day depends upon the spacecraft-earth distance, the telemetry bit rate, and the ground tracking time allotted to each spacecraft. Thus, the data obtained earlier in the life of each spacecraft are more complete. The solar wind parameters are given in the form of plots and listings. Trajectory information is also given along with a detailed description of the analysis procedures used to extract plasma parameters from the measured data. (auth)

33269 (N-74-21405) MODEL COMBINING THE POLAR AND THE SECTOR STRUCTURED SOLAR MAGNETIC FIELDS. Svalgaard, L.; Wilcox, J. M.; Duvall, T. L. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Jan 1974. 34p. (NASA-CR-137406; SU-IPR-557). NTIS $4.75.

A phenomenological model of the interplay between the polar magnetic fields of the sun and the solar sector structure is discussed. The solar sector boundary is tilted with respect to central meridian, and boundaries with opposite polarity change are oppositely tilted. The tilt of a given type of boundary ((+,–) or (–,+)) changes systematically during the sunspot cycle as the polarity of the polar fields reverses. If we consider (1) a sunspot cycle where the northern polar field is inward (–) during the early part of the cycle and (2) a (+,–) sector boundary at central meridian, then the model predicts the following pattern: a streamer at high northern latitudes should be observed over the west limb together with a corresponding southern streamer over the east limb. The current sheet runs now NW-SE. At sunspot maximum the boundary is more in the N-S direction; later when the polar fields have completed their reversal the boundary runs NE-SW and the northern streamer should be observed over the east limb and the southern streamer over the west limb. (auth)

33270 (N-74-21407) GREEN CORONA AND SOLAR SECTOR STRUCTURE. Antonucci, E.; Svalgaard, L. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Feb 1974. 16p. (NASA-CR-137407; SU-IPR-561). NTIS $4.00.

Analysis of the green line corona is presented for the interval 1947–1970 which suggests the existence of large-scale organization of the emission. The green line emission at high northern latitudes (approximately 40–60°) is correlated with the emission at high southern latitudes 6, 15, and 24 days later, while the low latitude green corona seems to be correlated on both sides of the equator with no time lag. These coronal features are recurrent with a 27-day period at all latitudes between ±60°, and these large-scale structures are associated with the solar magnetic sector structure. The high correlation between northern and southern high-latitude emission at 15 days time lag is explained

as a signature of a two-sector structure, while four sectors are associated with the 6- and 24-day peaks. (auth)

33271 (N-74-22422) STUDY OF THE MEAN SOLAR MAGNETIC FIELD. Scherrer, P. H. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Dec 1973. 158p. (NASA-CR-138131; SU-IPR-554). NTIS $11.00.

The magnetic field of the sun seen as a star was observed at the Mount Wilson Observatory. The sun-as-a-star field, or mean field, as measured in integrated sunlight was compared with both large scale averages of conventional solar magnetic maps and the interplanetary magnetic field observed near the earth. Three independent topics concerning the mean field observations and interpretation are discussed: (1) The relation between the mean field observations and models of large scale solar magnetic structure, (2) the nature of the comparison of the mean field with the interplanetary field, and (3) the relative contribution of fields on different parts of the solar disk to the mean field. (auth)

33272 (N-74-22429) SIMULATION OF COLLIDING SOLAR WIND STREAMS WITH MULTIFLUID CODES. Papadopoulos, K.; Clark, R. W.; Wagner, C. E. (Maryland Univ., College Park (USA)). Apr 1974. 14p. (NASA-CR-138174). NTIS $4.00.

The description of a multifluid code with anomalous transport coefficients due to plasma instabilities self-consistently followed in space and time is given. As an example, simulations of colliding solar wind streamers are presented. The results compare favorably with the observations. (auth)

33273 (N-74-22430) ENERGY SPECTRUM OF 0.16 TO 2 MeV ELECTRONS DURING SOLAR QUIET TIMES. Hurford, G. J.; Mewaldt, R. A.; Stone, E. C.; Vogt, R. E. (California Inst. of Tech., Pasadena (USA)). Feb 1974. 24p. (NASA-CR-138182; SRL-74-1). NTIS $4.25.

New observations of the quiet-time energy spectrum of 0.16 to 2 MeV electrons were made with the Caltech Electron/Isotope Spectrometer that was launched on IMP-7 in September 1972. Earlier measurements of quiet-time electrons in this energy range by other groups have resulted in spectra differing by more than an order of magnitude in intensity. A minimum quiet-time flux somewhat lower than the lowest previously reported spectra and consistent with an extrapolation of the spectrum measured at higher energies was found. A galactic secondary source of knock-on electrons is consistent with the results and with independent studies of the interstellar spectra of cosmic-ray nuclei provided that solar modulation does not suppress the 0.162 MeV electron flux by more than a factor of approximately 3. Although not required, other recently suggested sources may also contribute to the observed fluxes. (auth)

33274 RATIO OF TOTAL TO SELECTIVE EXTINCTION FROM THE CLUSTER DIAMETER METHOD. Harris, D. H. (Arizona Univ., Tucson). Int. Astron. Union Symp.; No. 52, 31-41(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

One hundred and fifty six open clusters with modern photometry, and apparent diameter measures by Trumpler, have been used to measure the mean ratio of total to selective extinction, R. It is found that cluster diameter is related to both concentration class and richness class. Diameter also seems to depend on the background stellar density and to decrease with reddening. With such effects measured and removed $R = 3.15 \pm 0.20$. This result is not significantly dependent on the cluster's position in space. (auth)

33275 NONEQUILIBRIUM DISTRIBUTIONS OF MOLECULAR STATES IN INTERSTELLAR SPACE. Townes, C. H. (Univ. of California, Berkeley). pp 739-768 of Fundamental and Applied Laser Physics. New York; John Wiley and Sons, Inc. (1973).

Current knowledge on the components of interstellar space and on interstellar dust clouds (which contain most of the molecules existing in interstellar space) is reviewed. The discovery of molecules by absorption of a microwave continuum or by emission from their own excited state is discussed in historical order, and the interpretation of their spectra is examined. The observed microwave resonances of interstellar molecules are tabulated. Another table shows the approximate column densities of molecules found in the directions of the Orion nebula and of Sagittarius. The various types of nonequilibrium encountered are demonstrated by examples. (IAA)

33276 KINETICS OF INTERSTELLAR GRAIN ORIENTATION. Derringh, E. G. Troy, NY; Rensselaer Polytechnic Inst. (1973). 153p. University Microfilms Order No. 74-12,782.

Thesis (Ph. D.).

A transformation of the Fokker–Planck equation from its usual form, in Cartesian momenta, to one especially suited for investigations of interstellar grain orientation has been carried out. In this new equation the distribution function is written in variables describing two coupled spherical coordinate systems: one fixed in the grain, and the other fixed in space. The relative simplicity and symmetry of the diffusion coefficients (average change in the dynamical variables in a short time) necessary for the equation's solution further justifies the development. Several particular situations were studied. First, for spheroidal grains interacting with atoms of a surrounding Maxwellian gas the expected Maxwell–Boltzmann distribution of orientations was found. A solution of the Fokker–Planck equation was obtained also for homogenous, spheroidal grains rotating in a uniform magnetic field with no gas present: the grain-field coupling was the Jones–Spitzer modification of the original Davis–Greenstein mechanism. For grains in a gas and magnetic field, several characteristics of the alignment were obtained by analytical studies of the Fokker–Planck equation (a numerical solution was not attempted). Amongst these are the expected results that in thermal equilibrium the distribution of grain axes in space is isotropic; also, and this is so far established only when the orienting (magnetic) effects are small compared with the disorienting (collision) effects, the sense of the orientation reverses accordingly as the grain temperature is greater or less than the gas temperature. Both of these results apply regardless of the elongation of the grain. It is assumed that a collision involves a sticking and evaporation of the gas atom. Finally, the orientation of spherical grains in a uniform flow, or stream, of atoms (Gold mechanism) is investigated and applied to hypothetical, spherical zodiacal light particles. (Diss. Abstr. Int., B)

33277 SOLAR RADIO BURSTS. Caroubalos, C. (Observatoire de Paris, Meudon, France). J. Phys. (Paris), Colloq.; No. 2, 63-68(1973). (In French).

From centenary congress of the French Physical Society; Vittel, France (28 May 1973).

The transient radio emissions of the sun arising from the interaction between the coronal plasma and suprathermal particles accelerated during certain chromospheric flares are studied. The spectral classification of the solar radio bursts is given and new results, mainly due to radiospectrographic and radioheliographic observations are presented. This permits a better understanding of the physical process giving rise to the emission. In particular the type III and type II bursts are examined as well as some components of type IV. Finally some applications of the study of the solar radio bursts outside of the field of solar physics, in astrophysics, in solar terrestrial relations as well as in numerous other domains of plasma physics are summarized. (FR)

33278 NONLINEAR WAVES IN THE SOLAR WIND. Kellogg, P. J. (Observatoire de Paris, Meudon, France). J. Phys. (Paris), Colloq.; No. 2, 69-76(1973). (In French).

From centenary congress of the French Physical Society; Vittel, France (28 May 1973).

A brief review of present understanding of the solar wind is given, followed by some recent results obtained with instruments on board the satellite IMP-6. These results include, (a) observations of plasma waves associated with the earth's bow shock, (b) observations of plasma waves (near the plasma frequency) which are sometimes associated with magnetic field discontinuities. (FR)

33279 DYNAMICS OF THE SOLAR ATMOSPHERE. Souffrin, P. (Observatoire de Nice). J. Phys. (Paris), Colloq.; No. 2, 59-62(1973). (In French).

From centenary congress of the French Physical Society; Vittel, France (28 May 1973).

The dynamics of a compressible atmosphere is discussed with special emphasis on wave-guiding. Within the geometric approximation arguments are developed for the existence of pulsational unstable zone, when applied to the solar atmosphere this supports the theory of self-sustained atmospheric modes. (FR)

33280 INTERPLANETARY MATERIAL. Millman, P. M. (National Research Council, Ottawa). J. Roy. Astron. Soc. Can.; 68: 13-22(Feb 1974).

From conference on chemical evolution in the Universe; Kingston, Ontario (6 Jun 1973).

The respective chemical compositions of meteorites, comets, and meteors are compared to each other and to the estimated composition of the whole solar system. Data on the abundance by weight of the various elements are available for meteorites through laboratory study, while abundances for meteors and comets are determined spectrographically and are therefore not exact. Fragmentary interplanetary material is divided on the basis of being relatively fractionated or unfractionated. The data are discussed in terms of the theory of solar system evolution according to which the planetary and interplanetary material condensed from a primordial nebula. (IAA)

33281 PHOTOCOULOMB GRAVITONS AND GRAVITATIONAL EMITTANCE OF THE SUN. Gal'tsov, D. V. (Moscow State Univ.). Zh. Eksp. Teor. Fiz.; 67: No. 2, 425-427(Aug 1974). (In Russian).

The cross section for photoproduction of a graviton by a charged particle in a plasma is derived by classical theory techniques. The gravitational radiation from the sun due to transformation of thermal electromagnetic radiation is estimated. (auth)

33282 THE ESCAPE OF ENERGETIC CHARGED PARTICLES FROM TRAPPING MAGNETIC STRUCTURES. Stevens, G. A. (Sterrekundig Instituut te Utrecht (Netherlands). Space Research Lab.). Astron. Astrophys.; 31: No. 2, 157-163(Mar 1974).

1 fig.; 12 refs.

The diffusive motion of charged particles in a magnetic field is derived from Liouville's equation supplemented with a term, describing a relaxation to momentum isotropy. The accessory relaxation time is estimated for collisional scattering and for scattering due to magnetic field fluctuations. It is concluded that the most probable escape mechanism of energetic protons from the sun is a direct injection into interplanetary space from an open magnetic configuration. (auth)

33283 SOLAR MODULATION. Fisk, L. A. pp 170-211 of High Energy Particles and Quanta in Astrophysics. McDonald, F. B. (ed.). Cambridge, MA; Massachusetts Inst. of Tech. Press (1974).

Some of the important aspects of modulation theory are summarized including the conditions in the interplanetary medium that affect the modulation. A set of equations are developed that can be used to describe cosmic ray behavior in the solar system, including the effects of diffusion, convection, and energy loss due to adiabatic deceleration in the expanding solar wind. Also the likely forms for unmodulated, interstellar cosmic ray spectra. Finally, solar cycle variations, energy loss effects, anisotropies, and gradients are considered. (JFP)

33284 SOLAR PARTICLES (OBSERVATIONS, RELATION TO THE SUN ACCELERATION, INTERPLANETARY MEDIUM). McDonald, F. B.; Fichtel, C. E.; Fisk, L. A. pp 212-272 of High Energy Particles and Quanta in Astrophysics. McDonald, F. B. (ed.). Cambridge, MA; Massachusetts Inst. of Tech. Press (1974).

The discussion covers flare-associated events, charge and isotopic composition of solar energetic particles, the solar flare and particle acceleration, and propagation. (JFP)

33285 FORECASTING CYCLIC COEFFICIENT SOLAR ACTIVITY. Kuksenko, V. I.; Mikhailovskii, V. M. (Physical-Mechanical Inst., Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. B; No. 6, 523-527(Jun 1974). (In Ukrainian).

The presence and synchrony of annual cycles in fluctuation of the average 20-day number of chromospheric flares on the sun and A_p geomagnetic index with the integral pulse characteristic of planetary tide-forming forces are shown. This offers an opportunity to forecast in an estimated way the period variation in the geomagnetoefficient solar activity within the 11-year cycle with practical useful reliability within 20 days. (auth)

33286 SOLAR WIND AND GEOMAGNETIC ACTIVITY. Formisano, V.; Moreno, G.; Signorini, C. (Comitato Nazionale per l'Energia Nucleare, Frascati, Italy). Nuovo Cim., B; 23B: No. 2, 473-488(11 Oct 1974).

Interplanetary plasma and magnetic-field parameters, measured by the ESRO satellite HEOS-1, were correlated with the D_{st}, taken as an index of the overall geomagnetic activity. It is found that two different states exist for the interaction between the solar wind and the magnetosphere: they correspond to quiet periods (D_{st} positive) and to disturbed conditions (main phase of geomagnetic storms, i.e. D_{st} negative). In disturbed conditions the magnetosphere appears to be much more sensitive to variations of the solar-wind dynamical pressure than in periods of positive D_{st}. (auth)

33287 478-keV AND 431-keV LINE EMISSIONS FROM ALPHA-ALPHA REACTIONS. Kozlovsky, B.; Ramaty, R. (Goddard Space Flight Center, Greenbelt, MD). Astrophys. J., Lett.; 191: No. 1, L43-L44(1 Jul 1974).

The existence of strong γ-ray lines from $\alpha\alpha$ reactions at 478 and 431 keV is pointed out. These lines are produced by the interaction of α-particles with helium nuclei leading to ^{7}Li and ^{7}Be in their first excited states. Doppler broadening blends these lines into a spectral feature which could be observable from large solar flares. This feature could also make an important contribution to emission from the galactic center around 0.5 MeV. (auth)

33288 NATURE OF THE SMALL-SCALE SOLAR MAGNETIC FIELD. Chapman, G. A. (Aerospace Corp., Los Angeles). Astrophys. J.; 191: No. 1, 255-259(1 Jul 1974).

It is proposed that the nonsunspot solar magnetic field has everywhere the same strength and that this field strength is approximately 1500 to 1800 gauss in the region of formation of moderate-strength Fraunhofer lines. Several points are presented in support of these ideas. (auth)

33289 ACCELERATION OF SOLAR COSMIC RAYS DURING CHROMOSPHERE BURSTS. Dorman, L. I.; Raichenko, L. V.; Yukhimuk, A. K. Kosm. Issled. Ukr.; No. 3, 45-49(1973). (In Russian).

Using the Fokker-Planck equation, the acceleration of charged particles by electrical fields caused by dispersion of high-intensity long radiowaves was studied. Correlation functions were calculated for electrical fields close to the limit of plasma instability. The interaction of charged particles with these fields is considered. As a result of interaction of particles with fluctuating fields, solar cosmic rays may be accelerated to an energy of 10^2-10^3 MeV. (tr-auth)

33290 EFFECT OF PROTON FLARES IN AUGUST 1972 ON RADIOWAVE PROPAGATION IN THE SUBAURORAL REGION. Boykov, V. I.; Chulina, E. M.; Katsevman, M. M.; Korovin, A. V.; Kurganov, R. A.; Lukin, I. V.; Minulin, R. G.; Nosova, G. N. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 946-947(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1116-1117(1973).

Several proton flares occurred on the Sun in August, 1972. The most intense flare occurred at 6h 05m UT on August 4. Maximum absorption reached 14 to 15 dB (f = 27 to 30 MHz) and signals in the LF and VLF ranges disappeared. Propagation via E_S is most probable in this case. There is no information on the ionosphere during a 12-hour span. Proton flares of such high intensity as the August 4 flare have a marked effect on subauroral paths, casting doubt on the question of the high effectiveness of rerouting during total blackouts in maintaining communications with northern regions. The results of the experiment at 27.86 MHz showed that even though scattered signals are subjected to the influence of PCA during the main phase, they are not subjected to the action of auroral absorption on subsequent days. Such communications become more stable, and the signals have a higher amplitude indicating the influence of E_S. (MCW)

33291 INJECTION SPECTRUM, ABSOLUTE FLUX, AND DURATION OF THE EMISSION OF SUN ACCELERATED PARTICLES ON FEBRUARY 23, 1956. Miroshnichenko, L. I. Kosm. Luchi; No. 14, 92-95(1974). (In Russian).

On the basis of more precise methods of determination of the solar cosmic ray spectrum beyond the Earth's atmosphere, the spectra of the direct and of the scattered particle fluxes during the flare event of 23 February 1956 are studied from ground based observations data. Data on the scattered flux spectrum are used to determine the particle spectrum at the moment of the emission (injection spectrum). Differential rigidity spectra can be represented, within the limits of experimental errors, by power functions $D(R) = D_0R^{-\gamma}$. The values of γ are 5.4 ± 0.2 (injection spectrum 03.42 UT); 3.5 ± 0.2 (direct flux, 04.00 UT); 6.8 ± 0.2 (scattered flux, 06.00 UT and 20.00 UT). The values of D_0 corresponding to the moments indicated above are $7.1 \cdot 10^3$; $2 \cdot 10^3$; $6 \cdot 10^3$ and $1 \cdot 10^2$ (in units $cm^{-2}\ sec^{-1}\ Gv^{-1}$). Data on the absolute flux of solar particles ($R > 1$ Gv) at 20.00 UT obtained through ground based observations are in good agreement with the results of stratospheric measurements at 19.30 UT ($R < 1$ Gv). An assumption based on the difference between the injection spectrum and the spectrum of the direct (anisotropic) flux can be made that the characteristic emission time is inversely proportional to the square of the particle rigidity. (auth)

33292 PHYSICAL CHARACTERISTIC OF SOLAR WIND FROM COMET OBSERVATION DATA. Tarashchuk, V. P. (Main Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 21, 62-69(1974). (In Russian).

The heliographic latitude distributions of mean solar wind bulk velocity are studied, using the data on the deviation angles of comet tail axes from a prolonged radius-vector for the years 1889 to 1963. It is shown that solar wind bulk velocity is lower in the solar equatorial zone (several degrees of heliolatitudes). There are zones of increase in the solar wind bulk velocity: 45°, 22°, 7°—for maximum solar activity and 12°, 40 to 45° and above 70°—for minimum solar activity. The velocity for minimum is somewhat larger than that for solar activity maximum. (auth)

33293 ACTIVE PROMINENCE OF APRIL 1, 1970 ELECTRONIC TEMPERATURE. Rakhubovskii, A. S. (Main Astronomical Observatory, Kiev). Astrometriya Astrofiz.; No. 21, 70-81(1974). (In Russian).

The results of spectrophotometry are given for the hydrogen lines $H_\alpha - H_{32}$ and continuum of an active prominence. The level populations for all the observed hydrogen lines as well as the

electronic density $n_e = 1.0 \cdot 10^{11}$ cm^{-3} and the electron temperature $T_e = 7200$°K were determined. The values of n_e and T_e for the active prominence correspond to ordinary values of these parameters for quiescent prominences. 25 refs, 4 figs, 2 tables. (auth)

33294 NATURE OF SOLAR ACTIVITY. Romanchuk, P. R.; Sergeeva, A. N. (Kiev State Univ.). Astrometriya Astrofiz.; No. 21, 82-92(1974). (In Russian).

The relation between the number of the spot groups f_0 and their average lifetime T_0 was studied for the years 1875 to 1968. It is found that T_0 diminishes with the increase in f_0 for each phase of the solar cycle. Moreover, T_0 increases from minimum to maximum. The variations of T_0 are connected with the variation in turbulent viscosity caused by natural oscillations of the convective zone layers (accumulation of energy during minima and its release during maxima of solar activity) and the convective zone oscillations due to the influence of planets. Turbulent viscosity changes during a secular cycle. Three types of the spot lifetime distributions are found. The features of the development of recurrent group for the 19th and 20th cycles are studied. A more rapid disintegration of groups is observed for the 20th cycle than for the 19th one. 12 refs, 7 figs, 7 tables. (auth)

33295 MYSTERY OF SOLAR NEUTRINOS. Schatzman, E. Astronomie; 88: 155-171(May 1974). (In French).

Recent experiments undertaken for detecting solar neutrinos brought results inconsistent with standard solar models. The reasons for this discrepancy are analyzed and hypotheses that would improve solar models are formulated. (FR)

33296 FORMULATION OF BASIC EQUATIONS FOR SPECTRAL LINE FORMATION IN THE PRESENCE OF A MAGNETIC FIELD. A non-LTE Problem. Sidlichovsky, M. (Astronomical Inst., Ondrejov, Czech.). Bull. Astron. Inst. Czech.; 25: No. 4, 198-206(1974).

The non-LTE equation of transfer in the presence of a magnetic field is presented. The theory is valid for arbitrary Zeeman patterns and the field is inhomogeneous. The Faraday effect is taken into account. The LTE source function (Planck function) is substituted by four functions, which generally depend on the direction and population of the levels. The vector source function ξ is the result of a detailed consideration of the emission processes in the presence of a magnetic field. These processes are studied by two different methods and the results are shown to be equivalent. The induced emission is neglected. If the Zeeman levels are unpolarized and the Boltzmann law for populations is valid, the non-LTE equation of transfer will change into the well-known LTE theory. The density matrix formulation is widely used. Radiative transition rates of two Zeeman levels of the atom in a general field of radiation (whose Stokes parameters are a function of direction) are calculated. These rates enter into the equation of statistical equilibrium which, together with the equation of transfer, form the complete set of equations for the Stokes parameters and populations of the Zeeman levels. (auth)

33297 FINE STRUCTURE IN CaII K LINE. Punetha, L. M. (Uttar Pradesh State Observatory, Naini Tal, India). Bull. Astron. Inst. Czech.; 25: No. 4, 207-212(1974).

Ca II K line spectrograms were traced at various wavelengths along the slit and also along the dispersion at regular intervals. Statistical properties, root mean square variations, full width at half maxima, autocorrelation functions, power and coherence spectra of intensity variations, and profile parameters are described and discussed. It is emphasized that the large scale feature contribution to the average profile, with particular reference to the coarse mottle structure, be properly taken into account in the multicomponent atmospheric models. (auth)

33298 INTENSITY OSCILLATIONS ACROSS THE Ca II K LINE. Punetha, L. M. (Uttar Pradesh State Observatory, Naini Tal, India). Bull. Astron. Inst. Czech.; 25: No. 4, 212-215(1974).

Intensities at various wavelengths in the Ca II K line over a 10 minute duration time series spectra were examined for oscillations. Three components were observed: 1) large period, $\geq$1000 second, due to the slowly evolving coarse network; 2) 300 second resonant oscillations; and 3) the 180 second transient recurrent phenomenon. Life history of a typical small scale K_{2v} emission feature is given. (auth)

33299 IDENTIFICATION OF THE C_2 PHILLIPS SYSTEM IN THE SOLAR SPECTRUM. Lambert, D. L. (Univ. of Texas, Austin); Mallia, E. A. Bull. Astron. Inst. Czech.; 25: No. 4, 216-220(1974).

A probable identification of the (1,0) band of the C_2 Phillips ($A'\Pi_u - X'\Sigma_g^+$) system in the solar photospheric spectrum is discussed. A band oscillator strength $f_{1,0} = 0.0022$ is derived from an analysis of the equivalent widths ($W_\lambda \sim 2$ mÅ). The results is compared with available laboratory and theoretical estimates. (auth)

33300 NITRIC OXIDE IN SUNSPOTS. Gaur, V. P. (Uttar Pradesh State Observatory, Naini Tal, India). Bull. Astron. Inst. Czech.; 25: No. 4, 220-222(1974).

The calculated equivalent width of R_1 (26.5) line of the 0-1 vibration-rotation band of NO near 5.3 μm for the sunspot model of Stellmacher and Wiehr (1970) suggests the likelihood of the presence of this band in sunspot spectrum. As the equivalent width of this line increases towards the limb, its detection will be easier near the limb, possibly by extra-terrestrial observations. (auth)

33301 SPATIAL DISTRIBUTION OF SOLAR ACTIVITY PHENOMENA IN THE 20TH SUNSPOT CYCLE. Vitinskii, Yu. I. (Astronomical Inst., Ondrejov, Czech.). Bull. Astron. Inst. Czech.; 25: No. 4, 222-231(1974).

Drawing on the data of photospheric background magnetic fields, photospheric faculae, Ca II plages, solar flares, sunspot groups, and solar corona for 1964-1970, the peculiarities of the active longitudes in the current 11-year cycle are investigated. Two types of active longitudes (main and secondary ones) were detected, the former penetrating the whole thickness of the solar atmosphere and the latter-only some of its regions. The spatial distribution of the background magnetic fields is shown to be less stable than the solar activity phenomena considered in the present paper. The reasons in favor of a relationship between the active longitudes and the 80 ÷ 90-year cycle are given. An attempt to interpret the detected peculiarities of the active longitudes is made. (auth)

33302 GLOBAL FLUID MOTIONS IN A UNIFORMLY ROTATING CONVECTIVE SPHERICAL SHELL STUDIED AS A MODEL OF THE SOLAR CONVECTION ZONE BY A VARIATIONAL METHOD. Yoshimura, H. (Tokyo Univ.). Publ. Astron. Soc. Jap.; 26: No. 1, 9-51(Mar 1974).

The behavior of the global nonaxisymmetric fluid motions in a uniformly rotating spherical shell of Boussinesq fluids with superadiabatic temperature gradient simulating the solar convection zone is investigated by a variational method from slow-rotation regime to fast-rotation regime, assuming that the horizontal scale of the motions is much larger than the vertical dimension. The number of terms of the expansion of the eigenfunction by a series of associated Legendre functions is taken as large as the prescribed precision requires. The global fluid motions in the spherical shell are classified into the convection mode and the Rossby mode according to the behavior of the motions. Among the results of the present work are that the behavior of the motions in the fast-rotation regime for the convection mode and in the slow-rotation regime for the Rossby mode significantly depends on the ratio of the kinematic viscosity to the thermometric conductivity; the sign of the direction of propagation of the patterns is a function of the magnitude of rotation; the effect of rotation makes the flows in the equatorial regions preferential in the slow-rotation regime, while it concentrates the flows into the high-latitude polar regions in the fast-rotation regime. (auth)

33303 SOLAR-TERRESTRIAL DISTURBANCES OF AUGUST 1972. III. Characteristics of Solar Radio Emission. Yamashita, F.; Mitobe, A.; Isobe, T. (Radio Research Lab., Nakaminato, Japan). Denpa Kenkyusho Kiho; 19: No. 103, 255-260(Jul 1973). (In Japanese).

The development of the S components and the characteristics of major radio events during the period are described. Three dynamic spectra are presented from observations in Japan, and polarizations at meter wave lengths are also shown. (auth)

Galaxies

Refer also to abstracts 33287 and 33571.

33304 (AD-740882) INTERSTELLAR ABSORPTION IN SELECTED AREA 47. Schreur, J. J. (Steward Observatory, Tucson, Ariz. (USA)). 14 Jul 1969. Contract N00014-67-C-0322. 30p. NTIS $3.00.

A study of the obscuration in the direction of Selected Area 47 (l (II) = 159 degrees, b (II) = -21 degrees) has been made. An absorbing cloud was found at a distance of 300 pc with a total visual absorption of 2.0 magnitudes. (auth)

33305 (N-74-22472) INDICATIONS OF THE ERUPTIVE DEVELOPMENT OF PLANETARY BODIES. Vsekhsvyatskii, S. K. (ed.). Jun 1974. Translated from pp 73-94 of Problemy Kosmicheskoy Fiziki, Kiev Univ. Press, 1971. 36p. NTIS $5.00.

The problems of comet astronomy, of the mean densities of

planets, of the specific planets rotational energy, of the geological processes scale, of the manifestations of volcanic activities of the planets are discussed for the evaluation of matter and energy losses of solar system planetary bodies. It is shown that these losses may be of order of 10 to the 29th power–10 to the 31st power G 10 to the 43rd power–10 to the 45th power erg during the period of the existence of the solar system planets. The deduction is made that the planets began life as bodies of stellar nature with very great supply of energy of the hot stellar matter. (auth)

33306 SURFACE POLARIZATION SURVEY OF THE MILKY WAY AND THE ZODIACAL LIGHT. Staude, J.; Wolf, K.; Schmidt, T. (Max-Planck-Institut fuer Astronomie, Heidelberg). Int. Astron. Union Symp.; No. 52, 139-141(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33307 ELIPTICAL POLARIZATION BY LIGHT SCATTERING BY SUBMICRON SPHEROIDS. Schmidt, T. (Max-Planck-Institut fuer Astronomie, Heidelberg). Int. Astron. Union Symp.; No. 52, 131-137(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Calculations have been carried out of single light scattering by Rayleigh type spheroidal dust particles. It can be shown that elliptical polarized radiation with e = v/p of about 0.15 can be produced from unpolarized incident radiation, in the case of dirty quartz particles with a refractive index m = 1.54 ± 0.4i and a geometrical axial ratio (c : a) of about 1 : 2. (auth)

33308 POLARIZATION OF LIGHT BY DUST IN GALAXIES. Elvius, A. (Stockholm Observatory, Saltsjobaden, Sweden). Int. Astron. Union Symp.; No. 52, 209-212(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Several galaxies were observed for polarization during April and May 1972. Preliminary results are presented concerning those galaxies where polarization can be expected because of selective extinction or scattering of light by interstellar dust. (auth)

33309 INTERSTELLAR POLARIZATION. Serkowski, K. (Tucson Univ., AZ). Int. Astron. Union Symp.; No. 52, 145-152 (1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

A review of observational data on interstellar polarization is given. The degree of fluctuation in the direction of the galactic magnetic field is discussed. An empirical formula is given which fits all the observations of the wavelength dependence of interstellar polarization when they are normalized with the wavelength (λ-max) of maximum polarization. Well-defined regions on the sky with values of λ-max deviating from an average are found. Values of λ-max are correlated with the ratio of total to selective interstellar extinction. A unified wavelength dependence of interstellar extinction is obtained by normalizing the observations with the wavelength λ-max of maximum interstellar polarization. (auth)

33310 ULTRAVIOLET SURFACE BRIGHTNESS OF REFLECTION NEBULAE AND THE ALBEDO OF INTERSTELLAR GRAINS. Lillie, C. F. (Colorado Univ., Boulder); Witt, A. N. Int. Astron. Union Symp.; No. 52, 115-122(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33311 DUST GRAINS IN REFLECTION NEBULAE. Zellner, B. (Arizona Univ., Tucson). Int. Astron. Union Symp.; No. 52, 109-113(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Observations and Mie theory calculations of colors and polarization in several reflection nebulae are compared. The discrepancies suggest the possibility that the Mie theory is failing because the extinction and angular-scattering properties of interstellar grains cannot be modeled by smooth spheres with a single radius. (IAA)

33312 BROADBAND STRUCTURE IN THE INTERSTELLAR EXTINCTION CURVE. Hayes, D. S. (Rensselaer Polytechnic Inst., Troy, NY); Mavko, G. E.; Radick, R. R.; Rex, K. H.; Greenberg, J. M. Int. Astron. Union Symp.; No. 52, 83-90(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Observations of the interstellar extinction in the range from 3400 to 11,000 A were analyzed. The observations have high photometric accuracy and wavelength resolution, and allow a detailed examination of broadband structure as well as the general shape of the wavelength dependence of the extinction curve. The broadband structure has a characteristic size of several hundred angstroms, and may be as important as the diffuse bands in indicating the physical nature of the grains. The preliminary theoretical interpretation of this broadband structure, and the new observation which it predicts is described. (auth)

33313 U, B, V, R, AND I EXTINCTIONS IN FOUR AREAS OF THE SOUTHERN COALSACK. Tapia, S. (Steward Observatory, Tucson, AZ). Int. Astron. Union Symp.; No. 52, 43-51(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

From star counts the extinctions in five spectral bands were determined for four areas of the Southern Coalsack. The wavelength dependence of the extinction values follows the Whitford curve. Minimum masses for six globules are given. (auth)

33314 SEARCH FOR INFRARED POLARIZATION IN THE GALACTIC CENTER. Maihara, T.; Okuda, H.; Sato, S. (Kyoto Univ.). Int. Astron. Union Symp.; No. 52, 191-196(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Polarization measurements of ir radiation from the galactic center have been conducted in the summers of 1970, 1971, and 1972, using the 36- and 74-in. reflectors at the Okayama Astrophysical Observatory. A preliminary interpretation is that the polarization at 2.2 microns is below 5%, which is much less than expected from interstellar polarization. (auth)

33315 PHOTODESORPTION FROM INTERSTELLAR DUST GRAINS. Greenberg, L. T. (California Univ., Berkeley). Int. Astron. Union Symp.; No. 52, 413-419(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

An experiment to measure the photodesorption of physisorbed gases from a cold fused quartz substrate by near uv photons is described. The observed yield (mol/photon) is as large as 0.00001, a higher yield is likely in the vacuum uv. Included is a discussion of the photodesorption process and some applications to the interstellar medium. The observed yield is enough to maintain molecular abundances in moderate density interstellar clouds in equilibrium. (auth)

33316 FORMATION MECHANISM FOR INTERSTELLAR MOLECULES. Harteck, P.; Beaudoin, A.; Reeves, R. (Rensselaer Polytechnic Inst., Troy, NY). Int. Astron. Union Symp.; No. 52, 395-398(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

The major ions in the region of the interstellar clouds include H^+ and H_3^+. The ions may be formed by photo ionization, cosmic rays, or other processes. The chemistry of H_3^+ is considered and reactions involving carbon atoms are described. The formation of nitrogen-containing molecules may occur mainly on interstellar grains. Reactions involving negative ions may also contribute to the production of certain species. (IAA)

33317 CHEMICAL EVOLUTION OF DENSE CLOUDS. Chapelle, E. W.; Donn, B. D.; Payne, W. A. Jr.; Steif, L. J. (Goddard Space Flight Center, Greenbelt, MD). Int. Astron. Union Symp.; No. 52, 387-393(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Attention is given to chemical processes which could determine the molecular composition of the cloud during the several stages of its evolution, taking into account thermal reactions at the relatively high interstellar densities expected during the processes. The origin of the observed molecules is discussed together with questions of molecular evolution during collapse of the cloud and the role of organic molecules in planetary chemical evolution. A number of experiments are also considered along with the application of the experimental results to cloud equilibrium problems. (IAA)

33318 INTERSTELLAR CIRCULAR POLARIZATION AND THE COMPOSITION OF INTERSTELLAR DUST. Martin, P. G. (Cambridge Univ., Eng.). Int. Astron. Union Symp.; No. 52, 161-167(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

This paper shows that optical observations of circular polarization produced by aligned interstellar grains could yield valuable information about the grain material. The interstellar medium is known to be linearly dichroic from observations of interstellar linear polarization; many different grain models using a large variety of compositions can be found to reproduce these observations. Since the same aligned grains make the medium linearly birefringent, a small component of circular polarization can result from incident linearly polarized light if the position angle of

the linear polarization does not coincide with either principal axis of the medium. Here calculations are presented to demonstrate that the wavelength of the circular polarization is sensitive to the imaginary part of the complex refractive index of the grain material. This provides an opportunity of investigating whether the grains are characteristically dielectric or metallic. Some possible observations are suggested. (auth)

33319 SOME SCATTERING PROBLEMS OF INTERSTELLAR GRAINS. Greenberg, J. M. (State Univ. of New York, Albany). Int. Astron. Union Symp.; No. 52, 3-9(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Consideration of the general effects of size, shape, chemical composition, index of refraction, temperature, and other physical parameters of small particles upon their scattering properties. A determination of the relative importance of these effects to interstellar dust interpretations is attempted with the ultimate aim of a full definition of interstellar grain optics. (IAA)

33320 DUST AND NEUTRAL HYDROGEN IN THE REGION OF IC 1396. Simonson, S. C. III. (Maryland Univ., College Park). Int. Astron. Union Symp.; No. 52, 227-229(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33321 OBSERVATIONS OF ATOMIC HYDROGEN IN DENSE INTERSTELLAR DUST CLOUDS. Knapp, G. R. (Maryland Univ., College Park). Int. Astron. Union Symp.; No. 52, 243-245(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

High frequency resolution 21-cm line observations of almost 100 interstellar dust clouds showed that about one-third of them contain significant amounts of cold neutral hydrogen. Simple models for the velocity distribution of hydrogen in the clouds were fitted to the observations, and spin temperatures ranging from 16 to 40°K and column densities from 7×10 to the 19th power to 6×10 to the 20th power atoms per sq cm were found. The ratios of H I to OH and H I to dust in the clouds were found to have about 1 to 10% of their value in the general interstellar medium. (auth)

33322 GALACTIC DUST DISTRIBUTION IN THE SOLAR NEIGHBORHOOD. Cahn, J. H.; Nosek, R. D. (Illinois Univ., Urbana). Int. Astron. Union Symp.; No. 52, 237-241(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Using the Shklovsky–Mindowski–Aller constant mass method of distances to planetary nebulae, a model of the Galactic dust distribution in the vicinity of the Sun has been determined. Distances are determined in part from extinctions derived from radio continuum to H beta flux ratios for an assumed electron temperature of 7000°K. The distance scale is based on the brightness of planetary nebulae in the Magellanic Clouds (Seaton, 1968). (auth)

33323 STUDY OF THE DISTRIBUTION OF INTERSTELLAR MATTER. Loden, L. O. (Astronomical Observatory, Uppsala). Int. Astron. Union Symp.; No. 52, 219-225(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

As a first step toward an empirical estimation of the minimum size of interstellar dust formation units (clouds etc.) the correlation between angular separation and difference in color excess has been studied for a selection of close star couples with coinciding magnitude and spectral type. Principally, the result indicates that there is no palpable correlation between the difference in color excess and the lateral separation of the stars. This and other properties speak in favor of the conception that obscuring matter in the Milky Way is concentrated in extremely small units of high density. (auth)

33324 PHOTON AND MAGNETIC ALIGNMENT OF INTERSTELLAR DUST GRAINS. King, L. W., Harwit, M. O. (Cornell Univ., Ithaca, NY). Int. Astron. Union Symp.; No. 52, 197-202 (1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Detailed examination of the effects of absorption of interstellar starlight photons and re-emission of infrared radiation on the most often mentioned mechanism for the observed alignment of interstellar dust grains, namely, paramagnetic relaxation. The results of the study indicate that neither paramagnetic relaxation nor photon alignment are sufficient to produce the observed alignment, either alone or working in conjunction with each other. (IAA)

33325 SPECTROSCOPIC SIMULATION OF DIFFUSE INTERSTELLAR LINES AND A LABORATORY MODEL FOR INTERSTELLAR CHEMICAL SYNTHESIS. Johnson, F. M.; Biley, D. T.; Wegner, P. A. (California State Univ., Fullerton). pp 317-321 of Interstellar Dust and Related Topics. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33326 MODELS OF THE INNER REGIONS OF THE GALAXY. Peters, W. L. III. Austin, TX; University of Texas (1974). 282p. University Microfilms Order No. 74-14,748.

Thesis (Ph. D.).

The 21 cm emission of neutral hydrogen from the inner regions of the galaxy is usually interpreted as indicating the presence of two spiral arms with large noncircular velocities moving outward from the galactic center. But the 21 cm emission does not put enough constraints on the galaxy to uniquely define the motions in its inner regions. Several alternate models of the inner regions were investigated. These were all based on observations of other galaxies and, where possible, on galactic dynamics. Only extremely simple versions of these models were considered since, given enough degrees of freedom, any one of these could reproduce the observations exactly. Of the models studied, the most successful were: a "material" bar with gas flowing along its axis, a barring combination, and a model with gas flowing in elliptical orbits (which approximates a density wave bar). The expanding spiral arm model and each of the above alternatives could reproduce the overall shape of the observed 21 cm emission, but the expanding spiral arm and the elliptical orbits model were the most successful. There is no observational evidence for spiral arms with large noncircular velocities in other galaxies. There is indirect observational evidence for elliptical orbits near the bars of barred spiral galaxies. A tremendous explosion in the past is implied by the expanding spiral arm model, whereas no energy is required by the elliptical orbits model. The elliptical orbits model has nearly as strong a dynamical basis as the highly successful spiral density wave theory. For these reasons, the elliptical orbits model was judged to be the most probable model for the inner regions of the galaxy. (Diss. Abstr. Int., B)

33327 X-RAY SPECTRUM OF NP0532. Thomas, R. M.; Rothenflug, R. (Tasmania Univ., Sandy Bay, Australia). Nature (London); 249: No. 5460, 812-814(28 Jun 1974).

A change reported in the x-ray spectral index of the Crab pulsar NP 0532 near 10 keV was examined quantitatively, using most of the published data and some unpublished data. The data reduction method is described in detail. The pulsed fraction was used as the basic spectral quantity, allowing the low energy spectrum to be treated independently of interstellar absorption. (UK)

33328 NEW LOOK AT THE INTERSTELLAR HYDROGEN THROUGH A VERY-WIDE-FIELD PHOTOGRAPHIC Hα SURVEY OF THE WHOLE MILKY WAY. Sivan, J. P. (CNRS, Marseille). Astron. Astrophys., Suppl. Ser.; 16: No. 1, 163-172(Jul 1974).

In order to extend the limit of detection of the general Hα emission in the galactic plane, a photographic survey was carried out with a new, 60°-field, high-luminosity camera using a very narrow interference filter centered on Hα. A mosaic of fourteen wide-field Hα plates is presented. This atlas sums up, as completely as possible, the Hα emission features for the entire Milky Way. The limiting emission measure is estimated to be less than 30 cm^{-6} pc. General, diffuse Hα emission was detected throughout the inner Sagittarius–Carina arm, and was found to be present in the Perseus arm. The survey revealed a number of new, large-scale regions of faint emission. They are cataloged and described. The survey also revealed unsuspected filamentary extensions of the Orion complex. (2 figures, 2 tables) (auth)

33329 GALACTIC X-RAY SOURCES. Holt, S. S. pp 308-367 of High Energy Particles and Quanta in Astrophysics. McDonald, F. B. (ed.). Cambridge, MA; Massachusetts Inst. of Tech. Press (1974).

The emphasis is on general discrete source models. General a priori considerations about x-ray emission mechanisms and their applicability under a variety of assumptions about source parameters and some attempts at the interpretation of contemporary data in terms of source models and the general considerations previously discussed are treated. (JFP)

33330 INTERSTELLAR REDDENING AT HIGH GALACTIC LATITUDES. Philip, A. G. D. (New York State Univ., Albany). Int. Astron. Union Symp.; No. 52, 263-267(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Research supported by the State University of New York and NSF. (16 references) (IAA)

33331 DISTRIBUTION OF INTERSTELLAR MOLECULES IN DUST CLOUDS AS DERIVED FROM LABORATORY EXPERIMENTS. Breuer, H. D. (Univ., Saabruecken, Ger.). Int. Astron. Union Symp.; No. 52, 399-404(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33332 OBSERVATIONS OF GALACTIC X-RAY SOURCES. Gursky, H. (American Science and Engineering, Inc., Cambridge, MA). pp 291, 293, 295-341 of Black Holes. New York; Gordon and Breach, Science Publishers, Inc. (1973).

From proceedings of the twenty-third summer school of theoretical physics; Les Houches, France (1 Aug 1972).

The observational techniques used are considered, giving attention to proportional counters, mechanical collimators, considerations on statistics, and a description of the x-ray satellite UHURU. The distribution of sources in the galaxy is explored, taking into account aspects of longitude distribution, maximum luminosity, minimum luminosity, the spectral content of the radiation, and the effect of anisotropic x-ray emission. The properties of individual x-ray sources are discussed along with supernova remnants, transient sources, and Magellanic cloud sources. (IAA)

33333 CORRELATION OF INTERSTELLAR REDDENING AND L ALPHA ABSORPTION. Jenkins, E. B. (Princeton Univ., NJ). Int. Astron. Union Symp.; No. 52, 247-250(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33334 SOME IMPLICATIONS OF THE DISTRIBUTION OF INTERSTELLAR MOLECULES. Snyder, L. E. Jr. (Virginia Univ., Charlottesville). Int. Astron. Union Symp.; No. 52, 351-361(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Consideration of the possibility that molecular observations of interstellar clouds may be useful for determining the stage of cloud evolution. It is concluded that, before interstellar clouds can be classified and meaningful models built, more must be learned about interstellar molecule formation and excitation. (IAA)

33335 KRAMERS–KRONIG ANALYSIS OF INTERSTELLAR EXTINCTION. Chiao, R. Y.; Feldman, M. J.; Parrish, P. T. (California Univ., Berkeley). Int. Astron. Union Symp.; No. 52, 59-61(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33336 SURPRISING CONSTANCY OF RELATIVE CHEMICAL ABUNDANCES IN DIFFERENT REGIONS OF INTERSTELLAR SPACE: PARTICULARLY FOR FORMALDEHYDE. Heiles, C. (California Univ., Berkeley); Gordon, M. A. Int. Astron. Union Symp.; No. 52, 375-379(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33337 DIFFUSE INTERSTELLAR FEATURES IN THE SPECTRA OF DUST-EMBEDDED STARS. Bromage, G. E.; Nandy, K. (Royal Observatory, Edinburgh). Int. Astron. Union Symp.; No. 52, 71-77(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Eleven diffuse interstellar features have been studied in the spectra of dust-embedded stars in Cyg OB2 (VI Cyg) (including a Wolf-Rayet star) and field stars in the same direction. The equivalent widths of the lines are all strongly correlated with each other and with E(B−V), but there is virtually no correlation with D line strength for these stars. The wavelength positions and half-widths of the diffuse lines appear to be the same for all stars studied. (auth) (IAA)

33338 SURFACE POLARIMETRY OF THE MILKY WAY. Wolstencroft, R. D. (Hawaii Univ., Honolulu). Int. Astron. Union Symp.; No. 52, 99-108(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Two methods of determining the state of polarization of the integrated light from the Milky Way are discussed. In the symmetry method, it is assumed that the polarized foreground zodiacal light possesses north/south symmetry relative to the ecliptic. In the method of two epochs, the above assumption is not needed, but instead, time variations of the zodiacal light are assumed to be insignificant; the results obtained by this method, although compatible with the values found by the symmetry method, do however show that time variations may have influenced this result. Although the evidence for a definite polarization of the Milky Way is persuasive it cannot yet be considered conclusive. (auth)

33339 SOUTHERN REFLECTION NEBULAE. van den Bergh, S.; Racine, R. (David Dunlap Observatory, Toronto). Int. Astron. Union Symp.; No. 52, 123-125(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

The Curtis Schmidt telescope at the Cerro Tololo Observatory has been used for a two-color survey of reflection nebulae in the Southern Milky Way. Major concentrations of reflection nebulae are found in Carina and in the zone from 250 to 270 deg galactic longitude. A conspicuous gap in the distribution of reflection nebulae occurs at about 275 deg galactic longitude. A detailed photometric and spectroscopic investigation of the stars imbedded in southern reflection nebulae is now in progress. (auth)

33340 ABUNDANCES OF INTERSTELLAR MOLECULES AND THEIR FORMATION ON GRAIN SURFACES. Salpeter, E. E.; Watson, W. D. (Cornell Univ., Ithaca, NY). Int. Astron. Union Symp.; No. 52, 363-367(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Surface phenomena on interstellar dust grains, which are relevant for molecule formation, are summarized. For various molecular species in the interstellar gas, the dependence of abundance on gas density and the degree of shielding of starlight is predicted. These predictions seem to fit with recent observations on carbonmonoxide, but there seems to be a discrepancy for formaldehyde. (auth)

33341 OPTICAL MEASUREMENTS ON SOLIDS OF POSSIBLE INTERSTELLAR IMPORTANCE. Huffman, D. R.; Stapp, J. L. (Arizona Univ., Tucson). Int. Astron. Union Symp.; No. 52, 297-301(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Optical constants of olivine (Mg, $Fe)_2SiO_4$, and magnetite, Fe_3O_4, are presented for the wavelength range from near infrared to far ultraviolet. A feature occurs in the optical constants of olivine at about 1460 A, but no structure that could give rise to a 2200 A interstellar feature is found. The most peculiar characteristic of the magnetite results is the large change of optical properties with temperature in the infrared. (auth)

33342 GENETIC RELATION BETWEEN INTERSTELLAR CLOUDS AND DUST CLOUDS. Shu, F. H. Int. Astron. Union Symp.; No. 52, 257-262(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

It is proposed that many of the denser dust clouds represent transient stages between the initiation of gravitational collapse of ordinary interstellar clouds by passage through a spiral galactic shock and the appearance of a stellar association. The interstellar gas is not processed at too rapid a rate (1) because the time spent between galactic shocks is appreciably longer than the free-fall collapse time of a typical dust cloud, and (2) because only a small fraction of the total mass of gas of a given collapsing cloud is converted into stars—the rest is presumably redispersed by various dynamical processes which accompany the formation of massive stars. It is noted that the residue of atomic hydrogen observed to exist in dark dust clouds is compatible with the interpretation that they are transient objects whose lifetimes are not longer than about 10 m.y. (auth) (IAA)

33343 DEPOLARIZATION EFFECT IN REFLECTION NEBULAE. Vanysek, V.; Solc, M. (Karlova Universita, Prague). Int. Astron. Union Symp.; No. 52, 127-130(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

The depolarization effects in reflection nebulae are caused by the size distribution, multiple scattering and irregularity of the grains. In the following abbreviated version of a study of the depolarization effect it is shown that the multiple scattering in reflection nebulae can lead to considerable decrease of the linear polarization. A sample of results obtained by the Monte Carlo method is tabulated. (auth) (IAA)

33344 PHOTOELECTRON EMISSION FROM INTERSTELLAR GRAINS. Watson, W. D. (Cornell Univ., Ithaca, NY). Int. Astron. Union Symp.; No. 52, 335-339(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Photoelectric emission from interstellar dust grains due to ultraviolet starlight is reinvestigated. Ejection of photoelectrons can make a substantial contribution to the heating of standard interstellar clouds. Both positive and negative grain charges are shown to be possible. (auth)

33345 EXPLODING INTERSTELLAR GRAINS AND COMPLEX MOLECULES. Greenberg, J. M.; Yencha, A. J. (New York State Univ., Albany, NY). Int. Astron. Union Symp.; No. 52, 369-373 (1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Description is given of theoretical and laboratory investigations of the effects of radiation on interstellar graphs which have formed by accretion of O, C, and N atoms in combination with hydrogen to yield a dirty ice mantle on some (generally silicate) core. The triggering of an explosive chemical reaction in the grain consisting of free radicals frozen in a matrix of photolyzed dirty ice material is seen as a possible source of complex interstellar organic molecules. Photochemical experiments conducted with simulated interstellar materials yielded numerous organic materials. (IAA)

33346 INTERSTELLAR DUST: OBSERVATIONS IN THE ULTRAVIOLET AND THEIR INTERPRETATIONS. Witt, A. N. (Univ. of Toledo). Int. Astron. Union Symp.; No. 52, 53-57(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Recent observations of interstellar extinction and diffuse galactic light in the ultraviolet are shown to suggest the existence of a bimodal size distribution of interstellar dust particles. A simple model which incorporates particles of the two size ranges is proposed in explanation of the observations of interstellar extinction and diffuse galactic light. (IAA)

33347 QUICK REVIEW OF INTERSTELLAR GRAINS. van de Hulst, H. C. (Leiden Observatory). Int. Astron. Union Symp.; No. 52, 569-573(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Questions concerning the existence of interstellar grains are considered together with the shape of the extinction curve. All interpretations agree that the grains are formed from the gas phase, presumably at condensation nuclei. Effects of a hostile environment on grain formation and survival are explored. It is pointed out that the dynamics of grains in grain-gas mixtures has a variety of consequences in processes on the largest scale (galactic structure) and on the smallest scale (star formation). (IAA)

33348 DUST IN H II REGIONS. Petrosian, V. (Stanford Univ., CA). Int. Astron. Union Symp.; No. 52, 445-452(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

The observed far infrared flux of H II regions is interpreted as evidence for the presence of internal dust absorbing a fraction of Lyman continuum photons. The effect of this dust on the required number of ionizing photons and on the helium to hydrogen line intensity ratios is discussed and analytic formulae describing these effects are presented for simplified models. (auth)

33349 LOW RESOLUTION SPECTRUM OF THE ORION NEBULA IN THE 60-300 MICRON RANGE. Swift, C. D.; Wittenborn, F. C.; Erickson, E. F.; Caroff, L. J.; Augason, G. C.; Mord, A. J.; Kunz, L. W.; Giver, L. P. (Ames Research Center, Moffett Field, CA). Int. Astron. Union Symp.; No. 52, 453-457 (1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33350 CIRCUMSTELLAR INFRARED EMISSION. I. The Circumstellar Origin of Interstellar Dust. Woolf, N. J. (Minnesota Univ., Minneapolis). Int. Astron. Union Symp.; No. 52, 485-504(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Theories concerning the origin of interstellar dust are discussed. According to one theory, the dust condenses in interstellar space. Another theory is concerned with the condensation of the dust in stellar envelopes and atmospheres. Arguments in favor of the second hypothesis are presented. The infrared evidence for the composition of interstellar dust is collected from studies of emission and absorption spectra of diffuse matter. The observations of circumstellar matter around evolved objects are considered, giving attention to the case in which dust is clearly not a remnant of the protostellar cloud. (IAA)

33351 ASSOCIATION OF DUST AND H I GAS. Braunsfurth, E. (Max-Planck-Institut fuer Radioastronomie, Bonn). Int. Astron. Union Symp.; No. 52, 231-235(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

The hypothesis that interstellar dust is associated with cold gas is advanced. To test this, such observational features of the gas that depend predominantly on the cold gas have to be isolated. Two such features are discussed, the 21-cm line strength in absorption and the intensity of narrow emission line components in intermediate galactic latitudes. It is shown that both features have a good correlation with the dust extinction. Various measurements of the gas to dust ratio are collected and some implications for the interstellar medium are discussed. (auth)

33352 ROCKET MEASUREMENTS OF THE GALACTIC BACKGROUND AT 100 MICRONS. Pipher, J. L. (Rochester Univ., NY). Int. Astron. Union Symp.; No. 52, 559-566(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33353 PHYSICAL STUDY OF A BRIGHT RIM IN THE HORSEHEAD NEBULA. Louise, R.; Sapin, C. (Marseille Observatoire). Int. Astron. Union Symp.; No. 52, 465-470(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

The well-known "Horsehead" nebula is photographed with narrow interference filters centered respectively on H-alpha and forbidden N II (6584 A). The forbidden N II to H-alpha ratio is deduced and its variation towards the Horsehead bright rim is studied. It is shown that the maximum value of the temperature is not reached on the rim itself but in a narrow zone located just behind it and ahead of the dark matter. (auth)

33354 INTERSTELLAR GRAINS IN MUSEUMS. Cameron, A. G. W. (Yeshiva Univ., New York). Int. Astron. Union Symp.; No. 52, 345-347(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

It is argued that carbonaceous chondrites, particularly of type 1, are probably collections of interstellar grains which have been mildly transformed through exposure to higher than normal temperatures, resulting in a loss of volatile materials. (auth)

33355 DESTRUCTION OF DIRTY ICE MANTLES BY SPUTTERING. Aannestad, P. A. (Goddard Inst. for Space Studies, New York). Int. Astron. Union Symp.; No. 52, 341-344(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Dirty ice mantles are destroyed efficiently by sputtering of He atoms when clouds encounter shock velocities greater than 13 to 15 km/sec. Destruction due to grain-grain collisions is found to be about .001 times less efficient. Sputtering in the hot intercloud medium should make intercloud grains smaller than cloud grains. (auth)

33356 COSMIC X-RAYS AND INTERSTELLAR DUST. Hayakawa, S. (Nagoya Univ., Japan). pp 283-296 of Interstellar Dust and Related Topics. Dordrecht, Netherlands; D. Reidel Publishing Co. (1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

Observational results of cosmic diffuse x-rays are reviewed with particular emphasis on soft x-rays. The intensity distribution of soft x-rays over the celestial sphere indicates that the diffuse component of soft x-rays consists of extragalactic and galactic contributions. The absorption of the soft x-rays in the interstellar medium results in heating and ionization of interstellar matter. The ionization rate by x-rays is estimated. The scattering of x-rays by interstellar dust grains produces a halo of an x-ray source and smears out the pulsation of x-ray emission. The scattering coefficient and the halo size are given for some typical grain models. The possibility that the dust grains gain relativistic energy is suggested. (auth)

33357 STATISTICAL MODEL FOR THE CLOUD STRUCTURE OF THE INTERSTELLAR MEDIUM. Taff, L. G.; Savedoff, M. P. (Mees Observatory, Rochester, NY). Int. Astron. Union Symp.; No. 52, 537-543(1973).

From conference on interstellar dust and related topics; Albany, NY (29 May 1972).

33358 X AND γ RADIATION OF THE SKY BACKGROUND. Montmerle, T.; Ryter, C. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 187, 13-27(Dec 1973). (In French).

Available data on the sky background radiation have been compiled taking into account stringent selection criteria. Those data to which the various corrections made by the authors are not explicitly mentioned are rejected. The remaining data are believed to form a consistent sample. They are displayed on a graph. The spectrum obtained exhibits a general power-law shape. The dispersion of the data points does not exceed a factor five, peak to peak. The existence, so frequently advocated, of "excesses" and "breaks" at several energies like 0.2 keV, 40 keV, 5 MeV, is marginally perceptible. Furthermore, the spectrum lies very close to the extrapolation of the extragalactic radio spectrum. It is concluded that the sky background is easily accounted for by a coupled synchrotron and Compton effects of distant objects. However, a slight excess around 10 MeV is still present and gives support to Stecker-Omnes's symmetrical cosmology model. (FR)

33359 CHARACTERISTICS OF THE LOCAL GALACTIC MAGNETIC FIELD DETERMINED FROM BACKGROUND POLAR-

IZATION SURVEYS. Wilkinson, A.; Smith, F. G. (Nuffield Radio Astronomy Labs., Jodrell Bank, Eng.). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 593-611(Jun 1974).

The range of resolutions and frequencies at which background polarization studies are now available makes it possible for the first time to investigate the frequency-dependent behavior of both the percentage and angle of polarization over a large area. This confirms that a considerable random magnetic field component exists, along with a system of magnetic fields showing large scale order. The high latitude distribution of polarized radiation is associated with the galactic loops, the polarization characteristics of which may be qualitatively explained by a shell source model. The field system described above is regarded as being perturbed by these relatively local features. (auth)

33360 CLUSTERS OF GALAXIES AND THE COSMIC LIGHT. Shectman, S. A. Pasadena, CA; California Inst. of Tech. (1974). 57p. University Microfilms Order No. 74-14,286.

Thesis (Ph. D.).

Because galaxies cluster in space, the cosmic background light due to galaxies is not smoothly distributed on the night sky. Spatial power spectra are predicted for the cosmic light fluctuations, based on the luminosity function for nearby galaxies and on the clumpiness of the galaxy distribution derived from galaxy counts. A measurement is made of the spatial power spectrum of the cosmic light on a series of photographic plates taken with the Palomar 48-inch (122 cm) Schmidt camera. This power spectrum is interpreted to provide a measure of the covariance of the galaxy distribution and the mean emissivity of galaxies in space. (Diss. Abstr. Int., B)

33361 ISOTOPIC ABUNDANCES AND LINE FORMATION IN THE ORION NEBULA. Wannier, P. G. (Princeton Univ. Observatory, NJ); Encrenaz, P. J.; Wilson, R. W.; Penzias, A. A. Astrophys. J., Lett.; 190: No. 2, L77-L79(1 Jun 1974).

Measurements of the spatial variation of $H^{12}C^{14}N$ and $H^{13}C^{14}N$ line emission from the molecular cloud associated with the Orion nebula indicate that $H^{12}C^{14}N$ has a high central opacity. This result seems to contradict a recent suggestion that the observed hyperfine structure of the line indicates a low opacity, which in turn would yield a $^{13}C/^{12}C$ abundance significantly different from other determinations. The observed hyperfine structure can be understood in the high opacity case if one considers radiative trapping in the lines. (auth)

33362 SEARCH FOR DEUTERIUM IN ORION AND DETECTION OF HIGH-VELOCITY FEATURES. Traub, W. A. (Harvard Coll. Observatory, Cambridge, MA); Carleton, N. P.; Hegyi, D. J. Astrophys. J., Lett.; 190: No. 2, L81-L84(1 Jun 1974).

A search was made for Dα emission near the bright Hα line in Orion. The observations revealed a high velocity Hα feature near -60 km s^{-1}, whose intensity varied across the nebula, ranging from 0.0005 to 0.005 relative to Hα; another much weaker feature, possibly also Hα, was observed at about -100 km s^{-1}. Because these high velocity Hα features partially overlap the expected position of Dα, one is at present only able to derive an upper limit $D/H < 1.3 \times 10^{-4}$ for the number ratio in Orion. (auth)

33363 THEORY OF RADIO VARIABILITY OF GALAXY AND QUASAR NUCLEI. Ozernoi, L. M.; Ulanovskii, L. E. (Lebedev Inst. of Physics, Moscow). Sov. Astron. AJ (Engl. Transl.); 18: No. 1, 4-10(1974).

Translated from Astron. Zh.; 51: No. 1, 8-20(1974).

Three fundamentally different types of model might serve to explain the radio variability of compact extragalactic sources: those in which (A) thermal plasma, (B) the magnetic field, or (C) the relativistic particles contribute the predominant energy density. Although model A, as developed by Shklovskii and van der Laan, provides a reasonable interpretation of some qualitative features of the radio variability observed in galaxy and quasar nuclei, it has encountered substantial difficulties, both qualitative and quantitative, as further data have been available. A theory of radio variability is presented for models B and C. These can also account qualitatively for the observed variability behavior, but model C, like model A, fails to explain some basic quantitative properties whereas model B does yield good agreement. For example, only in model B is the exponent δ in the relation $F_{\nu_m} \propto \nu_m^{\delta}$ (maximum flux density F_{ν_m} occurs at frequency ν_m) equal to 0.70-0.85 if $\gamma = 2$-3, in accord with observation. An empirical test involving circular-polarization measurements is suggested to verify that model B can afford a theoretical basis for the theory of variable radio sources. (auth)

33364 SHOCK-WAVE PROPAGATION IN THE INTERPLANETARY MEDIUM. III. Krymskii, G. F.; Transkii, I. A. (Inst. of Cosmophysical Investigations and Aeronomy, Yakutsk, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 857-864(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1011-1019(1973).

The formation of shock fronts in the interplanetary medium produced by the interaction of a slow flux with an overtaking flux is analyzed. Because of the curvature of the flow lines of matter, caused by the rotation of the sun, a fast gas flux will overtake the slow flux and penetrate into it. The problem is solved without linearizing the principal equations, making it possible to allow for the real disturbances of solar-wind velocity. (auth)

33365 SECTOR STRUCTURE OF THE INTERPLANETARY MAGNETIC FIELD IN 1960 AND 1964. Mansurov, S. M.; Mansurova, L. G. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 865-868(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1020-1024(1973).

The results are reported of determinations in 1960 and 1961 of the signs of interplanetary magnetic field sectors from the types of daily geomagnetic variations at polar stations. It is demonstrated that various types of geomagnetic variations in 1958 display north-south and spring-autumn asymmetries that have been identified earlier while separating variations into types from satellite data. (auth)

33366 GALAXY FORMATION IN NONLINEAR GRAVITATIONAL-INSTABILITY THEORY. Doroshkevich, A. G.; Shandarin, S. F. (Inst. of Applied Mathematics, Moscow). Sov. Astron. AJ (Engl. Transl.); 18: No. 1, 24-29(1974).

Translated from Astron. Zh.; 51: No. 1, 41-49(1974).

The problem of galaxy formation is discussed in terms of the nonlinear theory of gravitational instability. Gas compressed by a shock wave is considered to be turbulized by hydrodynamic instability; it disintegrates into separate clouds analogous to globular star clusters and then, because of gravitational instability of a thin disk, into individual objects that may become spiral galaxies. The parameters of the newly formed objects are estimated. A discussion is given of the possibilities for turbulization of the gas. (auth)

33367 STUDIES OF NEBULAE AND OF INTERSTELLAR MATTER. Idlis, G. M.; Karyagina, Z. V.; Rozhkovskii, D. A.; Fesenkov, V. G.; Pyaskovskaya-Fesenkova, E. V.; Omarov, T. B.; Livshits, G. Sh. Tr. Astrofiz. Inst., Akad. Nauk Kaz. SSR; 9: 3-130(1968). (In Russian).

In this collection of articles, results are published on studies of reflective nebulae of interstellar matter carried out in the Astrophysical Institute of the Kazakh Republic. A significant part of the collection is devoted to the systemization of the photometric and morphological properties of reflective nebulae, and their relations with dark clouds, stellar associations and aggregations. The data are published in the form of a catalogue of nebulae, and a general review of the nebulae is presented. In the remaining articles, new data are presented on diffuse galactic radiation in the region of the Lebed' association, on the structure of interstellar absorptive matter in the vicinity of nebula NGC 7023, on luminous nebulae surrounding bright stars of the Pleiades, and on the spectrophotometric and polarimetric properties of separate interesting nebulae. A new solution is presented to the problem of the luminosity of a spherical nebula having a central point source of light. A Monte Carlo method was programmed for use on a digital computer. (SJR)

33368 IDENTIFICATION OF X RAY SOURCES. Amnuel, P. R.; Akhudova, G. V.; Guseinov, O. Kh. Tsirk. Shemakh. Astrofiz. Observ.; No. 5, 11-14(May 1973). (In Russian).

An attempt was made to correlate x-ray emitters with various types of galactic objects. From a search of a connection between x-ray emitters and galactic objects it was possible to identify only the supernovae residues as possible sources of x radiation. Radiosources, the HI and HII regions, variable stars, new stars, Wolf–Rayet stars and planetary nebulae could not be correlated as sources of x rays. (SJR)

33369 PROBLEMS IN THE PHYSICS OF NEBULAE AND NONSTATIONARY STARS. Idlis, G. M.; Karyagina, Z. V.; Livshits, G. M.; Omarov, T. B. (eds.). Tr. Astrofiz. Inst., Akad. Nauk Kaz. SSR; 17: 3-104(1971). (In Russian).

The collection of articles presents the results of calculating the intensity of diffuse galactic radiation, and also the results of polarimetric and photometric observations of nebulae and stars. The albedo value of dust particles is estimated. Theoretical calculations are presented on models of slightly compressed stellar systems. A transfer equation is derived for stellar systems. The problem of gravitational instability is considered. A program in Algol language is described for identifying spectral lines on a computer. (SJR)

33370 PHYSICS OF STARS AND NEBULAE. Idlis, G. M.; Karyagina, Z. V.; Livshits, G. Sh.; Omarov, T. B. (eds.). Tr. Astrofiz. Inst., Akad. Nauk Kaz. SSR; 16: 3-130(1971). (In Russian).

The collection of articles presents studies of nebulae (galactic and outer-galactic), interstellar matter and nonstationary stars. New data are presented on the luminous polarimetric properties of the large Orion nebula, the photometric characteristics of reflective nebulae, and the diffuse radiation of absorptive regions of the Milky Way. Calculations are carried out on the luminosity of isolated dark clouds illumined by the radiation of galactic stars, and also on the general diffuse galactic luminosity. New data are presented on observations of a number of nonstationary stars, on the basis of which conclusions are derived on the physical state of their shells. A transmission Schmidt chamber is described, and a computer program is presented by means of which it is possible to ease the numerical labor of handling observational data. In studies of outergalactic astronomy, functions are derived on the distribution of galaxies according to absolute magnitudes. Theoretical studies are published on problems of galactic dynamics, the evolution of stellar systems, and the origin of density fluctuations in an expanding Universe. In addition, a number of problems of motion in a relativistic gravitational field are considered. (SJR)

33371 NATURE OF GALACTIC X RAY SOURCES. Guseinov, O. Kh. Tsirk. Shemakh. Astrofiz. Observ.; No. 5, 7-10(May 1973). (In Russian).

At present only 12 x ray sources have been identified while more than 100 are known. In this case 6 of the sources are residues of supernovas; 4 are probably binary systems with an outflow of matter; one source is an x-ray nova and one source is a complex one in the direction of the Galaxy center. The coordinates of 93 selected, x-ray sources were compared with the coordinates of known galactic objects which could in principle emit x rays. Correlation was carried out with the following objects: dark galactic nebulae, HII regions, supernovae residues, radiosources, spectral binaries, visible binaries, scattering accumulations, Wolf–Rayet stars, planetary nebulae and various types of variable stars. Good agreement of the coordinates and x-ray spectra was found for the novae, stars of the Wolf–Rayet type and for supernovae residues. According to luminosity x-ray sources can be separated at least into two classes. The first class are the bright distance sources whose number in the Galaxy is >200. The average distance between sources is ~2 kps; the average luminosity is 4×10^{36} erg/sec. The source distribution in the galactic plane is approximately homogeneous. Sources of the second class are weak and near with a total number of about 700. The average x-ray luminosity is 3×10^{33} erg/sec. The luminosity varies as the square of the distance. The number of sources is inversely proportional to the luminosity. The total galactic luminosity in the x-ray region is on the order of 10^{38} to 10^{39} erg/sec. Sources of the first class are more variable. It is concluded that the x-ray sources are a new class of objects. They cannot be planetary nebulae or Wolf–Rayet stars. Their physical nature has not yet been explained. (SJR)

33372 EXCITATION OF LONGITUDINAL OSCILLATIONS IN INTERPLANETARY PLASMA BY TRANSVERSE ELECTROMAGNETIC RADIATION. Kotsarenko, N. Ya.; Yukhimuk, A. K. Kosm. Luchi; No. 14, 124-127(1974). (In Russian).

The phenomenon is studied of the generation of low frequency longitudinal oscillations in a magnetized plasma by a transverse electromagnetic wave which creates in a plasma with rare collisions a drift of electrons relative to ions. A numerical estimation of the critical amplitude value of a high-frequency field responsible for the development of the low frequency instability shows that the effect under consideration is accessible to experimental observations. (auth)

33373 ABOUT ONE OF THE POSSIBLE MECHANISMS OF INHOMOGENEITY FORMATION IN THE INTERPLANETARY MEDIUM. Kotsarenko, N. Ya.; Koshevaya, S. V.; Yukhimuk, A. K. Kosm. Luchi; No. 14, 120-123(1974). (In Russian).

A review of the existing literature on mechanisms of inhomogeneity formation in the interplanetary medium is given. By using interplanetary plasma observation data the authors have shown a good agreement of Dennison's theory with the experiment. (auth)

33374 PHYSICS OF NEBULAE AND OF NONSTATIONARY STARS. Idlis, G. M.; Karyagina, Z. V.; Livshits, G. Sh.; Omarov, T. B.; Rozhkovskii, D. A. Tr. Astrofiz. Inst., Akad. Nauk Kaz. SSR; 14: 3-112(1969). (In Russian).

This collection of articles considers a number of problems in the theory of luminosity from gas-dust nebulae. A presentation is made on a number of simple models approximating the properties of reflective nebulae. Results are given on photometric and spectrophotometric studies of separate nebulae and nonstationary stars which are physically related to emission and reflective nebulae. Methods are presented for the use of a digital computer in making photometric and polarimetric calculations, and also for theoretical calculations of light scattering in nebulae. (SJR)

33375 DENSITY WAVE MODEL. Roy, A. K. (Jadavpur Univ., Calcutta). Bull. Astron. Inst. Czech.; 25: No. 4, 247-250(1974).

From the solution of the general gas dynamical equations with perturbations the magnitudes of the density and potential perturbations and those of the velocity perturbations were calculated assuming that the angular velocity of the pattern is a function of the distance from the galactic center. The assumption is found to be reasonable everywhere, except at the central region where there is a singularity. The perturbation in the velocity of gas is more significant than that of the stars. The magnitudes of the density and potential perturbations at smaller distances from the center are found to be much larger than those obtained by assuming the angular velocity of the pattern to be 20 $km \cdot sec^{-1} \cdot kpc^{-1}$ throughout. The large density of the stars near the center is an obvious manifestation of the fact that the central region forms a distinct percentage of the total mass of the whole Galaxy. The abnormal deviation of the magnitudes of the radial velocity perturbations from the expected values near 3-kpc arm may be associated with some agency responsible for the unusual dynamical behavior of that arm. (auth)

33376 GALACTIC MOTION AS SOURCES FOR HEATING OF THE INTERGALACTIC AND INTRACLUSTER MEDIUM. Schipper, L. (Univ. of California, Berkeley). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 21-29(Jul 1974).

It is often suggested that the motions of galaxies can play a role in the heating of the intergalactic or intracluster medium. In the specific case of the Coma cluster it is shown that under ordinary assumptions the motion of its galaxies probably could not have heated the hot gas there. Under certain conditions of galactic structure and cluster evolution, however, significant heating from the motions of galaxies would be expected. Evidence is also presented indicating that the two giant ellipticals near the center of Coma may be able to provide most of the drag heating required by X-ray observations. The effect of galactic motions on a possible clumpiness in the intracluster medium is also discussed for Coma. Finally the possibility that galactic shocks played an important role in the heating of the general field IGM is discussed briefly and dismissed. Recently several authors have discussed the possibility that the intergalactic gas is heated by the supersonic motions of the galaxies. Earlier reviews of the thermal history of this gas (Ginzburg & Ozernoy; Weymann) as well as the most recent reviews of the subject (Field) speculate on various kinds of heat sources. More specifically, certain authors have dealt with the various aspects of shocks from moving galaxies and galactic wakes (Spiegel; Rudermann & Spiegel; Hunt & Sciama). It is proposed to re-examine the possible effects of galactic shocks on the intergalactic gas both in clusters and in the general field. (auth)

33377 RADIO EMISSION ASSOCIATED WITH THE BRIGHTEST GALAXIES IN CLUSTERS. Guthrie, B. N. G. (Royal Observatory, Edinburgh). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 15-19(Jul 1974).

From a consideration of the positions of the brightest galaxies and of radio sources in clusters, values or upper limits for the radio power P_{1445} at 1445 MHz associated with the brightest galaxies are derived. Values of P_{1445} greater than $10^{23} W\ Hz^{-1} sr^{-1}$ are more common for very dominant galaxies and for the brightest galaxies with double or multiple nuclei. (auth)

33378 GALAXY FORMATION WITHOUT PRIMORDIAL TURBULENCE. Mechanisms for Generating Cosmic Vorticity. Binney, J. (Oxford Univ.). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 73-92(Jul 1974).

It is shown that neither the tidal interaction between protogalaxies nor turbulent dynamo action can account for the observed vorticities of spiral galaxies. Doroshkevich's suggestion that vorticity generated in shock waves might account for the rotation of spiral galaxies is then investigated. A relation is obtained for the vorticity generated in a generally curved shock front. Applying this result to a collapsing protocluster of galaxies it is found that this mechanism does indeed provide more than adequate vorticity to account for spiral galaxy formation. On the basis of this model there is a natural explanation of the tendency of spiral or elliptical galaxies to cluster together. There should also be a correlation between the relative proportions of spirals and ellipticals and the shape of a cluster itself. The application of this analysis to the Virgo Supercluster gives a different pattern of peculiar velocities for the galaxies in the solar neighborhood from that expected on the basis of the primordial turbulence model. When more precise data on the anisotropy of the 2.7 K background becomes available, this may enable us to choose between these two theories. (auth)

33379 SPECTROPHOTOMETRY OF SIX SEYFERT NUCLEI. Martin, W. L. (Radcliffe Observatory, Pretoria). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 109-119(Jul 1974).

Intensities of emission lines in the wavelength region λλ 3300 to 6750 (at 50 and 150 Å mm^{-1}) are presented for the six Seyfert galaxies: NGC 1068, 1566, 3783, IC 4329A, NGC 6814 and NGC 7469. Three of these (NGC 1566, 3783 and 6814) have no previously published, quantitative spectrophotometric data. Values for the reddening, electron temperature and density and relative helium abundance are derived and line profiles are discussed. Line intensity variations are suspected for NGC 1566 and 6814. (auth)

33380 HOW LONG DO RADIO GALAXIES EMIT AT RADIO WAVELENGTHS? Tovmassian, H. M.; Shirbakian, M. S. (Astronomical Observatory, Erevan). Nature (London); 250: No. 5466, 474(9 Aug 1974).

An analysis was made of a large number of clusters of galaxies taken from the Palomar Sky Survey prints, and their radio emission was examined from the point of view of the proportion of their lives in which such emission might be expected to occur. (UK)

33381 LOCAL DENSITY GRADIENT AND GALACTIC PARAMETERS DETERMINED FROM NEARBY STARS. Cruz-Gonzalez, C. (Univ. Nacional Autonoma de Mexico, Mexico City). Mon. Notic. Roy. Astron. Soc.; 168: No. 1, 41-52(Jul 1974).

A solution of the Liouville-Boltzmann equation has been fitted to a group of stars catalogued by Woolley et al. (R. Obs. Ann.; No. 5 (1970)). By integration of this solution, the mass density gradient in the solar vicinity has been computed, resulting in $(\partial \log \nu/\partial \log R)_{R_0} = -5.1 \pm 0.5$ for the standard values of the Oort constants. With Freeman's exponential model of the Galaxy, A fixed to be 15 km s^{-1} kpc^{-1} and the fitted solution, some of the local rotation parameters and the surface density gradient have been computed. The results are as follows: $AR_0 = 133 \pm 8$ km s^{-1}, $(\partial \log \nu/\partial \log R)_{R_0} = -2.8 \pm 0.3$, $B = -10.7 \pm 2.3$ km s^{-1} kpc^{-1}, $R_0 = 8.9 \pm 0.5$ kpc, $V_0 = 228 \pm 24$ km s^{-1}. In this case the density gradient is $(\partial \log \nu/\partial \log R)_{R_0} = -4.8 \pm 0.3$. (auth)

Cosmology

Refer also to abstracts 33246, 33571, and 34123.

33382 COSMOLOGICAL MODELS AND THE LARGE NUMBERS HYPOTHESIS. Dirac, P. A. M. (Florida State Univ., Tallahassee). Proc. Roy. Soc. (London), Ser. A; 338: No. 1615, 439-446(16 Jul 1974).

The large numbers hypothesis asserts that all the large dimensionless numbers occurring in nature are connected with the present epoch, expressed in atomic units, and thus vary with time. It requires that the gravitational constant G shall vary, and also that there shall be continuous creation of matter. The consistent following out of the hypothesis leads to the possibility of only two cosmological models. One of them, which occurs if one assumes that the continuous creation is a multiplication of existing matter, is Einstein's cylindrical closed universe. The other, which occurs if one assumes the continuous creation takes place uniformly through the whole of space, involves an approximately flat Minkowski space with a point of origin where the big bang occurred. (auth)

33383 REGISTRATION OF NEUTRINOS PRODUCED IN RELATIVISTIC COLLAPSE. Bisnovatyi-Kogan, G. S.; Seidov, E. F. (Inst. of Applied Mathematics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 19: No. 9, 319-320(5 May 1974).

Translated from Zh. Eksp. Theor. Fiz., Pis'ma Red.; 19: No. 9, 617-619(5 May 1974).

A possibility is indicated of detecting high-energy neutrinos ($E_\nu \gtrsim 30$ MeV) by means of the reaction $A^Z(\nu, e^-)E^{Z+1}$, with subsequent emission of a neutron from the highly-excited nucleus A^{Z+1}. (auth)

33384 NUCLEAR PHYSICS OF NEUTRON STAR MATTER AT SUBNUCLEAR DENSITIES. Negele, J. W. (Massachusetts Inst. of Tech., Cambridge). pp 605-646 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33385 VARIATIONAL AND REACTION-MATRIX CALCULATIONS OF NEUTRON STAR MATTER. Siemens, P. J. (Niels Bohr Inst., Copenhagen); Pandharipande, V. R. pp 647-664 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33386 NUCLEI IN NEUTRON STARS. Kisdi, D. (Univ. of Technical Sciences, Budapest); Nemeth, J. pp 665-674 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33387 SOLID NEUTRONS STARS: FACT OR FICTION. Clark, J. W. (Washington Univ., St. Louis). pp 675-704 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33388 ENERGY-DENSITY FORMALISM WITH APPLICATION TO NEUTRON STAR MATTER AND R-PROCESS NUCLEOSYNTHESIS. Buchler, J. R. (Yeshiva Univ., New York). pp 731-744 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33389 NONUNIFORM RELATIVISTIC COSMOLOGICAL MODELS. Stoyanov, V. I. (Inst. of Astrophysics, Dushanbe, USSR). Dokl. Akad. Nauk Tadzh. SSR; 17: No. 4, 17-20(1974). (In Russian).

The subject models are developed mathematically. (TTT)

33390 COSMIC CONNECTION: AN EXTRATERRESTRIAL PERSPECTIVE. Sagan, C. Garden City, NY; Doubleday and Co., Inc. (1973). 287p. $7.95.

A general discussion of the universe with emphasis on the possibilities of intelligent life on the other planets of the solar system and of other solar systems. Possible means of communicating with extraterrestrial beings (such as the engraved plaque on the Pioneer 10) are discussed. A prime consideration is that other cosmic civilizations will be at different stages of civilization; according to a scale proposed by N. S. Kardashev a civilization is rated in terms of the energy available to it for communication purposes. Other topics include the Mariner 9 probe of Mars, pulsars, the evolution of the universe, and the life cycles of stars. Black holes are discussed as possible apertures into different parts of the universe in different time epochs. (IAA)

33391 GRAVITATIONAL COLLAPSE. Maldybaeva, E. Ya. (Astrophysical Inst., Dushanbe, USSR). Dokl. Akad. Nauk Tadzh. SSR; 17: No. 2, 15-17(1974). (In Russian).

In view of the fact that discovery of black holes requires knowledge of their properties, the dynamic history of a star with supercritical mass was examined. A model of the collapse was developed, considering the correction of the development from the original point of time to time T, so that the original perturbations do not prevent it from reaching a steady state. This required solution of the operation of the physical system, using the gravitational equation with the proper boundary conditions. The computational methods indicated in the literature were examined, deriving a collapse model which functions as an ultimate control system. (TTT)

33392 STRUCTURE (TOPOLOGY) OF THE UNIVERSE. Zeldovich, Ya. B. COASB; 5: No. 6, 169-173(1973).

The discussion of the structure of the universe includes various theories, time and space, possible but unnecessary changes of topology, and perturbations of an isotropic uniform universe. The problem is demonstrated rather than given a final solution. (JFP)

33393 BLACK-HOLE PHYSICS: AN INTRODUCTION. Sexl, R. U. (CERN, Geneva). Postepy Fiz.; 25: No. 4, 327-371(1974). (In Polish).

Black-hole physics is a new and exciting part of relativistic astrophysics. The lectures presented here are intended to be an introduction to this field, requiring no knowledge of general relativity or astrophysics (except for the qualitative features of the Hertzsprung–Russell diagram). I hope that these lecture notes will enable the non-specialist to follow the present discussion concerning the experimental discovery of black holes. I have tried, furthermore, to show that many connections exist between elementary particle physics and astrophysics. A number of problems are given in the text. Solutions to the problems are included in an appendix. (auth)

33394 IS A COSMOLOGICAL SUBSTRATUM COMPATIBLE WITH RELATIVITY. Prokhovnik, S. J. (New South Wales Univ., Kensington, Australia). Int. J. Theor. Phys.; 9: No. 5, 291-303 (May 1974).

A cosmological substratum for energy propagation is defined in terms of a hypothesis by McCrea (Proc. Math. Soc. Univ. Southampton; 5:15(1962)). It has been shown that the assumption of such a substratum for a uniformly expanding universe provides a cosmological interpretation of Special Relativity, and leads further to a theory of gravitation in terms of a universal acceleration field. Following a critical discussion of the bases of General Relativity, it is suggested that the proposed substratum model and its consequences are also compatible with the General Relativistic approach, providing that this is applied in a manner which recognizes the centrally directed character of gravitational fields, and hence employs harmonic coordinates as proposed by Fock (The Theory of Space, Time and Gravitation, Pergamon, London. (1959). It is shown that Fock's procedure leads to results which are consistent with the assumption of a uniformly expanding cosmological substratum. Finally, it is suggested that the cosmological substratum concept is also implied by the formulation of the Robertson-Walker metric. (auth)

Planetary Phenomena

Refer also to abstracts 33266, 33476, and 33863.

33395 (AD-773572) POSITION AND STOKES PARAMETERS OF THE INTEGRATED 21 cm RADIO EMISSION OF JUPITER AND THEIR VARIATION WITH EPOCH AND CENTRAL MERIDIAN LONGITUDE. Report No. 1973-17. Berge, G. L. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1973. Contract N00014-67-A-0094-0019. 35p. NTIS $3.25.

Interferometer observations of Jupiter using short antenna spacings were made in 1968 and 1970 at 21.1 cm wavelength and in 1971 at 18.7 cm. The flux density, centroid position, and complete polarization state of the integrated emission were determined at many different central meridian longitudes. A small displacement of the emission centroid from the center of the planet may have been detected. Of greater importance, perhaps, is that a displacement larger than about 0.15 radii is ruled out. The observations confirm the slow decrease in flux density over a period of years, and extend the time base to eleven years, during which there has been no start of a recovery from the decline. The variation of flux density and polarization with central meridian longitude changed character in several respects from earlier observations. Some, but not all of these changes can be explained by the change in our aspect angle since the earlier observations. (auth)

33396 (N-74-21436) MICROPALEONTOLOGICAL STUDIES OF LUNAR AND TERRESTRIAL PRECAMBRIAN MATERIALS. Final Report. Schope, J. W. (California Univ., Los Angeles (USA)). Mar 1974. 14p. (NASA-CR-134232). NTIS $4.00.

Optical microscopic and scanning electron microscopic studies of rock chips and dust returned by Apollo 14, 15, 16, and 17 are analyzed along with optical microscopic studies of petrographic thin sections of breccias and basalts returned by Apollo 14, 15, and 16. Results show no evidence of modern or fossil lunar organisms. The lunar surface is now, and apparently has been throughout the geologic past, inimical to known biologic systems. (auth)

33397 PLASMAS AND RADIO EMISSIONS FROM PLANETS. Boischot, A. (Observatoire de Paris, Meudon, France). J. Phys. (Paris), Colloq.; No. 2, 77-80(1973). (In French).

From centenary congress of the French Physical Society; Vittel, France (28 May 1973).

The planet Jupiter is source of two different types of non-thermal radioemission: (1) on centimetric and decimetric wavelengths, an emission from high energy electrons trapped in the Van Allen belts of the planet; (2) in the decametric range, an emission probably due to the interaction of the Jovian ionosphere and streams of electrons released by the passage of the satellite Io. The study of those emission already gave many informations on the structure of the magnetic field of Jupiter, but the theory of the emission mechanisms is not yet clear. (FR)

33398 SHELL FLASHES IN PLANETARY NUCLEI. Van Horn, H. M.; Hansen, C. J. (Univ. of Colorado, Boulder). Nature (London); 249: No. 5456, 429-431(31 May 1974).

It is stated that a satisfactory explanation for the postulated high internal magnetic fields in planetary nuclei has not yet been suggested, but it is suggested that a natural mechanism for the production of such fields may be present in at least some planetary nuclei. A prominent feature of the evolution of magnetic A stars is the occurrence of one or more thermal runaways, or "flashes", in an unstable shell source that produces nuclear energy. Near the peak of such a flash a transient convection zone is developed, and if the star has even a modest amount of differential rotation, generation of magnetic field by stellar dynamo action can occur. In order to investigate the plausibility of dynamo field generation in the planetaries it is necessary to have estimates of the rate of differential rotation and of the properties of the transient convection zones. Little is known, however, about the differential rotations. The variety of proposed models is briefly discussed, including results typical of these models, including application to the sun. A candidate for observational tests would seem to be the star FG Sge, which appears to be undergoing an active shell flash at present. (UK)

33399 IMPLICATIONS OF THE PIONEER 10 MEASUREMENTS OF THE JOVIAN MAGNETIC FIELD FOR THEORIES OF Io-MODULATE DECAMETRIC RADIATION. Smith, R. A. (Goddard Space Flight Center, Greenbelt, MD); Wu, C. S. Astrophys. J., Lett.; 190: No. 2, L91-L95(1 Jun 1974).

The configuration of the magnetic field of Jupiter imposes constraints upon theoretical models of decametric emission triggered by Io, with respect to such features as the frequency of the emission, the density of the inner plasmasphere, and the beaming pattern. Owing to the northern offset of the field model reported by Smith et al., the upper ranges of observed decametric frequencies can be equated to the electron gyrofrequency only in the northern hemisphere, in regions outside the trapping volume of radiation-belt particles. Emission mechanisms in which the frequency is at or very near the electron gyrofrequency must be stimulated by Io either through acceleration and precipitation of particles or through generation of magnetohydrodynamic waves. Mechanisms invoking trapped particles are consistent with wave amplification in the southern hemisphere at the upper hybrid frequency, imposing a lower bound on the density of thermal plasma near the planet. The field configuration is not easily correlated to the various frequency ranges of the modulated sources—an indication that the beaming pattern of the emission may significantly affect the decametric phenomenology. (auth)

33400 SEARCH FOR HD IN THE SPECTRUM OF URANUS: AN UPPER LIMIT TO [D/H]. Lutz, B. L.; Owen, T. (State Univ. of New York, Stony Brook). Astrophys. J.; 190: No. 3, 731-734(15 Jun 1974).

The P(1) line of the 4-0 rotation-vibration band of HD was sought in the spectrum of Uranus. No feature which could be identified with any certainty was found, yielding an upper limit on the column density of HD in the J = 1 rotational level of ηN_1 (HD) < 331 meter-amagat (m-Am). At 85°K this estimate corresponds to an upper limit of the total HD column density of $\eta N(HD) < 860$ m-Am and a deuterium to hydrogen ratio of $[D/H] < 4 \times 10^{-4}$. (auth)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstracts 33290 and 33482.

33401 (AD-772711) MEASUREMENTS AND APPLICATIONS OF IONOSPHERIC TOTAL ELECTRON CONTENT. Final Report, 15 September 1970–14 September 1973. Yeh, K. C.; Flaherty, B. J.; Youakim, M. Y.; Wetenkamp, S. F. (Illinois Univ., Urbana (USA). Dept. of Electrical Engineering). Oct 1973. Contract F19628-71-C-0013. 119p. (UILU-ENG-73-2558; AFCRL-TR-73-0658). NTIS $4.50.

Investigations on ATS-F receiver design and applications of electron content to propagation problems are described. The planned ATS-F satellite will transmit radio signals at several frequencies with associated modulations. These transmissions will enable experimenters to perform several measurements. These are Faraday rotation, dispersive Doppler and dispersive group delay. Based on design considerations a portion of the phase-lock receiver has been built and tested. The receiver seems to meet all requirements on both Faraday rotation and dispersive group delay measurements. Two propagation problems have been investigated. The first is concerned with the relation between the maximum usable frequency and electron content. The second is concerned with the effects of horizontal gradients on elevation angle and azimuthal angle of arrival of a radio signal. (auth)

33402 (AD-774396) STUDY OF IONOSPHERIC PLASMA. Hieblot, J.; Thue, M. (Foreign Technology Div., Wright-Patterson AFB, Ohio (USA)). 30 Jan 1974. Translation of pp 49-60 of a French Report. (FTD-HC-23-434-74). 19p. NTIS $4.00.

The contents are: high hybrid resonance, low hybrid resonance, self-impedance probes, Soviet mass spectrometers, EIDI program, ISIS program, study of magnetospheric plasma, French experiment on the GEOS (CERS–ESRO) satellite, ARAKS program, measurement of the electric field, the "Dragon" experiment, launched from Argentina, OMEGA-2 campaign, studies of particle precipitation in the auroral region by means of rocket sondes, CALIPSO and ARCADE experiments. (auth)

33403 (AD-777818) SCINTILLATION AND POLARIMETER MEASUREMENTS AT COLLEGE, ALASKA. Final Scientific Report, 1 April 1971–30 June 1973. Merritt, R. P.; Faust, G. H. Jr. (Alaska Univ., College (USA). Geophysical Inst.). 20 Dec 1973. Contract F19628-71-C-0113. 118p. (AFCRL-TR-74-0041). NTIS $4.50.

The scintillations and polarimeter measurements being conducted on a routine basis by the Geophysical Institute of the University of Alaska at College, Alaska, on Air Force Cambridge Research Laboratories contract number F 19628-71-C-0113, are summarized. The purpose of this contract is to record the behavior of the total electron content of a column of the ionosphere and the scintillation induced on a vhf radio signal passing through that column from a beacon radio transmitter located on the NASA ATS-1 geostationary satellite. Specific events are discussed to indicate the relationship between the scintillation data, the polarization data, and other geophysical phenomena routinely obtained at the Geophysical Institute. (auth)

33404 (AD-778087) MULTIFREQUENCY, LONG WAVE, VERTICAL SOUNDING OF THE LOWER IONOSPHERE. Reinisch, B. W.; Sales, G. S. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). 20 Dec 1973. 14p. (AFCRL-TR-74-0002; AFCRL-ERP-460). NTIS $3.00.

Vertical pulse sounding at 30, 60, 180, and 520 kHz at Quabbin Reservoir, Ma, USA, reveals diurnal and seasonal variations in structure, reflectivity, and height of the lower ionosphere. A solid state wideband amplifier feeds 10 kw peak power into a ground-laid six-element antenna. A special digital sampling and integration scheme selects median values of amplitude and phase received at perpendicular loop antennas. Day and nighttime D-region model profiles are fitted to the observed data by matching group height and reflection coefficient. Emphasis is placed on the nighttime residual E-layer observed at 100 km with an electron density, under undisturbed conditions, around 1000/cc. Long and short term variability of this layer is considerable. It is often semi-transparent as indicated by simultaneous E- and F-region echoes, suggesting the presence of a valley above the nighttime E-layer. (auth)

33405 (AD-914774) RESULTS OF WEATHERVANE TEST SERIES. Special Technical Report No. 1. McDaniel, D. R. (Stanford Research Inst., Menlo Park, Calif. (USA)). Nov 1973. Contract DAHC60-70-C-0016. 13p. (SRI-8189-1). NTIS $4.00.

During June of 1973 four ionospheric barium releases were made at the Kwajalein missile range (KMR). This test series, codenamed Weathervane, is part of a larger research program codenamed Haprex (high-altitude propagation experiment) that is investigating the use of barium plasma techniques as a means of measuring the performance of mitigating algorithms when applied to radars in a realistically perturbed environment. The principal objective of weathervane was to establish the feasibility of conducting future experiments at KMR when a barium plasma cloud is placed so that raypaths between the radar and the target pass through the cloud. This objective was partially achieved. (auth)

33406 (COM-74-10823) SATELLITE RADIO BEACON STUDIES OF THE IONOSPHERE. Final Report 13 February 1970–11 February 1974. Lal, J. B.; Dutta, H. N.; Gupta, S. K. (Kurukshetra Univ. (India). Dept. of Physics). Feb 1974. Contract NOAA-E76-70(N). 128p. NTIS $9.50.

Results of faraday-rotation observations of radio signals emitted from the satellites Be-B and Be-C are presented. The first chapter describes the observations and results of faraday rotation of 40 MHz radio signals emitted from the satellite explorer 22 (S-66) taken at Kurukshetra from June 1968 to April 1969, a period of high solar activity. Information is given on findings of electron content during magnetic storms, scintillation of satellite signals, characteristics of scintillation producing irregularities, regular satellite scintillations, and large scale ionospheric irregularities. (GRA)

33407 (COM-74-10904) PROTON RING CURRENT AND ITS INTERACTION WITH THE PLASMAPAUSE; STORM RECOVERY PHASE. Williams, D. J.; Lyons, L. R. (National Oceanic and Atmospheric Administration, Boulder, Colo. (USA)). Feb 1974. 43p. (NOAA-TM-ERL-SEL-31). NTIS $5.25.

Using data from the Explorer 45 satellite, the interaction of the proton ring current with the plasmapause during the December 17, 1971 geomagnetic storm was studied. The observed spatial, pitch angle, and energy distributions are shown for the near-midnight proton ring current for prestorm quiet, main phase, and recovery phase. Initial measured distribution functions are also shown. (Modified author abstract)

33408 (COM-74-50087-354) IONOSPHERIC DATA. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Feb 1974. 132p. (NOAA-ISPDA-FA-354; NOAA-74031202). NTIS $1.45.

The publication now contains monthly medians only for the same month the publication is issued. For example, the January 1973 issue includes all the data available for January 1973 and any previous unpublished data for January from earlier years. Also published are detailed data for the same month from an exemplary station, Wallops Island (Washington), including daily-hourly values of all characteristics, F-plots for regular world days, and an N(H) contour graph. As timely information, there is included selected ionospheric data for a retrospective world interval, when appropriate. Also given is information on ionospheric data recently received at World Data Center A for solar-terrestrial physics and other information on availability of data from the WDC's. (GRA)

33409 (RSD-71) IONIZATION CONTRIBUTION BY COSMIC X-RAYS. Mitra, A. P.; Ramanamurty, Y. V. (National Physical Lab., New Delhi (India)). 1971. 22p.

The contribution of cosmic x rays in the production of ionization in the night-time D region is discussed from observed x-ray flux emissions from the various celestial x-ray sources and from the galactic background. The cumulative effect of several sources when they are in transit at close time intervals can amount to a sizable fraction of all night-time sources that consist principally of scattered Ly-α and Ly-β. Above 95 km the Ly-β contributions are generally far in excess of the production due to cosmic x rays, but at and around 90 km, the relative importances of cosmic x rays and scattered Ly-α depends on the variation of the scattered Ly-α flux, its variations with time, and on the night-time concentration of nitric oxide, and also on the variation in the flux from the sources. Since some of these are uncertain, exact contributions are difficult to establish, but a marginal ionospheric effect from cosmic x ray sources seems possible around 90 km. (Indian Sci. Abstr.)

33410 (RSD-76) EQUATORIAL D-REGION. Somayajulu, Y. V.; Avadhanulu, M. B.; Zalpuriks, K. S. (National Physical Lab., New Delhi (India)). 1972. 15p.

The electron-density profiles in the D region obtained by rocket sounding at the geomagnetic equator are briefly reviewed. The study shows that the transition from cosmic ray to Lyman alpha as the dominant ionization source occurs between 65 and 70 km. The observed behavior is found to be consistent with the current concepts of ionization production by Lyman-alpha radiation and cosmic rays in the D region. These electron-density profiles are utilized to develop a diurnal model of the equatorial D region. (17 references) (Indian Sci. Abstr.)

33411 QUIET-TIME CURRENTS AND ELECTRIC FIELDS PRODUCED BY THE IONOSPHERIC DYNAMO. Schieldge, J. P. Los Angeles; Univ. of California (1974). 122p. University Microfilms Order No. 74-12,472.

Thesis (Ph. D.).

The global magnetic variations on a number of magnetically quiet days are simulated using a model of the ionospheric dynamo that allows currents to flow freely along field lines between hemispheres and a model of the equatorial electrojet. The ionospheric dynamo is driven by a combination of tidal winds [the diurnal (1,-2) and semi-diurnal (2,2), (2,3), (2,4) modes] objectively determined from an analysis of the actual data. The winds vary with height and include the dissipative effects of molecular viscosity, molecular heat conductivity, and ion drag. A realistic model of the global conductivity distribution is used. In the simulation, the eastward equatorial electric field derived from the global dynamo model is used to compute the electrojet currents and associated magnetic variations. The results of the simulation indicate the winds driving the dynamo have a universal time component. Furthermore, the study shows the importance of the semi-diurnal tidal winds in driving the dynamo. Observations of $E \times B$ drifts at middle and equatorial latitudes are reproduced by the present method. The results agree quite well with observations, recorded at Millstone Hill and Arecibo, that indicate the presence of semi-diurnal winds in the dynamo mechanism. The diurnal variation of the magnetic field and the vertical $E \times B$ drift at the magnetic equator are calculated. The results indicate that the (2,3) antisymmetric semi-diurnal tidal wind is the primary driving force in generating field aligned currents. Also, the post-sunset and pre-sunrise enhancements in vertical $E \times B$ drifts observed by the Jicamara radar are shown to be produced by diurnal tidal winds in the presence of large conductivity gradients occurring at these times. Simulation of the afternoon counter-electrojet effect at the magnetic equator show that it can be explained in terms of a combination of solar and lunar semi-diurnal tidal winds. Finally, it is shown that tidal winds generated at, or below, ionospheric heights can be of influence on quiet-time plasmasphere dynamics due to the electrostatic fields they generate in the ionosphere which are projected up along highly conducting field lines to plasmaspheric heights. (Diss. Abstr. Int., B)

33412 AURORAL ZONE ELECTRIC CURRENT MEASUREMENTS ON SOUNDING ROCKETS. Bering, E. A. III. Berkeley, CA; Univ. of California (1974). 212p. University Microfilms Order No. 74-20,280.

Thesis (Ph. D.).

An instrument, the split Langmuir probe, has been developed to make in situ measurements of ionospheric current density and plasma bulk flow. (Diss. Abstr. Int., B)

33413 MAGNITNO-IONOSFERNYE VOZMUSHCHENIIA I POTOKI AVRORAL'NYKH ELEKTRONOV. (Magneto-Ionospheric Disturbances and Auroral Electron Flues). Osipov, N. K.; Pivovarova, N. B.; Pivovarov, V. G. Moscow; Izdatel'stvo Nauka (1973). 90p.

This monograph discusses the results of theoretical and experimental studies of physical conditions which develop in the ionosphere during nighttime auroral disturbances producing homogeneous and diffused aurorae borealis reaching one to two points in intensity. Values of the parameters of nighttime sporadic ionization obtained by vertical radio sounding in the period from 1965 through 1967 are also given. Computer calculations are carried out to determine the parameters of interactions between electron fluxes and the atmosphere. The dynamics of polar magnetic disturbances and the generation of electric field in an auroral ionosphere are discussed. (IAA)

33414 SOLAR-TERRESTRIAL DISTURBANCES OF AUGUST 1972. IX. A Study of Traveling Ionospheric Disturbances in F-Region. Takenoshita, Y. (Radio Research Lab., Akita, Japan); Echizenya, Y.; Koizumi, T.; Ohyama, H. Denpa Kenkyusho Kiho; 19: No. 103, 323-329(Jul 1973). (In Japanese).

A study of traveling ionospheric disturbances (T.I.D's.) during the first half of August, 1972 has been done. The geomagnetic field and the ionosphere were disturbed in this period. T.I.D's. were confirmed by f-plots at four ionospheric observatories distributed in Japan. It was suggested that several T.I.D's. were generated at the auroral oval when auroral substorms were induced, that two T.I.D's. corresponding to geomagnetic sudden commencements traveled to the low latitude with constant velocity, and that T.I.D's. whose velocity vectors predominantly directed along east-west line were generated over sunrise or sunset line. It was reported that T.I.D's. with high and low velocities were observed when the geomagnetic field was disturbed and calm, respectively. (auth)

33415 HEIGHT-TIME VARIATIONS OF THE INTEGRAL ELECTRON DENSITY OF THE IONOSPHERE BASED ON INCOHERENT-SCATTER DATA. Tkachev, G. N.; Lazarenko, V. M.; Moshnyakov, N. V. Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 949-951(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1119-1121(1973).

Results are reported that characterize the variations in the integral electron density N_0 with height z, time t, and magnetic-solar activity. The $N_0(z)$ profiles were determined by measuring the height dependence of the angle of rotation of the polarization plane of incoherently scattered signals due to the Faraday effect. The measurements were made at middle latitudes in the USSR. The asymmetry of the diurnal variation of N_0 and its day-to-day variability are characteristic. The diurnal N_0 pattern was asymmetric regardless of the season or solar-activity cycle. Time dependence, averaged over several days, of N_0 to heights of 300 to 600 km for September 1969, 1970, 1971, and March 1970 is shown. Magnetic and solar activity data during the observation period are shown. Further calculations show that as the height increases, the relative amplitude of $N_0(t)$ fluctuations decreases sharply. (MCW)

33416 CORRELATION FUNCTION OF AURORAL IONIZATION FLUCTUATIONS. Pogorelov, V. I.; Tomashuk, L. Ya. Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 952-953 (1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1122-1123(1973).

Radar studies of auroral ionization have shown that at frequencies $f \geq 50$ MHz, the signals reflected from it are chiefly due to single scattering and should be adequately described in the Born approximation. Further investigations of the various numerical solutions lead to the following estimates for a_1: $a_1 \approx 0.03$ m; $a_2 \approx 0.2$ m; and $a_3 > 10$ m. This means that auroral ionization fluctuations are formations of the type of fragments of bands stretched along the magnetic field and oriented in the plane of the magnetic meridian. Such shape of δN inhomogeneities suggests a wave mechanism of their formation. (MCW)

33417 DETERMINATION OF THE TRUE HEIGHTS OF E_S LAYERS FROM VERTICAL SOUNDING IONOGRAMS. Mal'tseva, O. A.; Chernysheva, S. P.; Sheftel, V. M. (Rostov-on-Don State Univ., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 948-949(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1118(1973).

Mal'tseva has shown a method for determining the value of $\delta h'E_S = h'E_S - hE_S$ by the group retardation of radiowaves in the underlying region. It can be estimated either by calculating N(h) profiles or by tabulation on the basis of a model for specific E-region parameters. The second method consists in determining $\delta h'E_S$ for a model with specific parameters: the limiting frequency of the E_S-layer, and the half-thickness and critical frequency of the E layer approximated by a parabola. The method is described and the calculation results were used to study the diurnal variations of $\delta h'E_S$ for several days in May and June 1967. (MCW)

33418 NIGHTTIME ELECTRON-DENSITY PATTERN AT HEIGHTS 100 TO 200 KM. Starkova, A. G. (Inst. of Applied Geophysics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 875-877(1973).

Translated from Geomag. Aeron.; 13: No. 6, 1033-1036.

It is demonstrated that the behavior of electron density differs at middle and high latitudes at night. Electron density varies gradually at middle latitudes and reaches a minimum after midnight, while it increases immediately after sunset at high latitudes. The value of minimum electron density at middle latitudes depends on the solar activity level. (auth)

33419 STRUCTURE OF THE DISTRIBUTION OF ELECTRIC CURRENTS IN THE LOW-LATITUDE IONOSPHERE (DIURNAL PATTERN). Krylov, A. L. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 878-882(1973).

Translated from Geomag. Aeron.; 13: No. 6, 1037-1041.

The behavioral characteristics of currents in the low-latitude ionosphere, associated with the sharp change in conductivity upon transition from the day to the night side, are investigated. It is demonstrated that the equatorial electrojet flowing on the day side unfolds near the morning and evening meridians and closes at high latitudes, producing S_q variations. (auth)

33420 VERTICAL WIND PROFILES AND E_s-LAYER FORMATION AT MIDDLE LATITUDES. Andreeva, L. A.; Katasev, L. A.; Komrakov, G. P.; Nesterov, V. P.; Uvarov, D. B.; Chasovitin, Yu. K. (Inst. of Experimental Meteorology, Obninsk, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 883-885(1973).

Translated from Geomag. Aeron.; 13: No. 6, 1042-1046.

Experiments on simultaneous determination of vertical wind and electron density profiles are described. Electron density was measured with an impedance probe on the ascending segment of the trajectory and a luminous trail formed on the descending segment. Computations by formulas of wind shear theory showed a satisfactory correlation between the positive extremes of convergence and electron density maxima, which speaks in favor of this theory. (auth)

33421 ENERGY SPECTRA OF AMPLITUDE FLUCTUATIONS ON PATHS OF DIFFERENT LENGTH. Balinov, V. V.; Berezin, Yu. V.; Kiselev, V. A.; Smirnov, V. I.; Tsvetkov, S. S. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 886-889(1973).

Translated from Geomag. Aeron.; 13: No. 6, 1047-1051.

The results are reported of computations of the energy spectra of amplitude fluctuations during wave propagation on a short and a long path. The character of the spectra is analyzed and the reasons for their characteristics are explained. The agreement between the temporal correlation radii of amplitudes and the period of the dominant harmonics of the spectra is discussed. The objectivity of the wave disturbance parameter as a measure of signal scatter is examined. (auth)

33422 EFFECT OF RADIO-WAVE ABSORPTION IN THE DEVIATIVE REGION OF THE IONOSPHERE ON THE DIURNAL PATTERN OF TOTAL ABSORPTION. Kvavadze, D. K.; Tukhashvili, K. I. (Tbilisi State Univ., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 890-893(1973).

Translated from Geomag. Aeron.; 13: No. 6, 1052-1055.

The effect of absorption in the deviative region on the diurnal pattern of total absorption is analyzed on the basis of data from Tbilisi. It is demonstrated that total absorption decreases during radio-wave reflection from a blanketing E_s layer, whose height is less than that of the normal E layer, and so does the absorption value at a constant solar zenith angle. (auth)

33423 COMPOSITION OF THE ATMOSPHERE AT HEIGHTS OF 150 TO 200 KM. Krasnopol'skii, V. A. (Inst. of Space Research, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 898-900(1973).

Translated from Geomag. Aeron.; 13: No. 6, 1060-1063.

Jacchia's 1970 model of the atmosphere with T_b = 1100°K and von Zahn's model with the same temperature profile, constructed using the N_2, O, and O_2 concentration at 150 km, are examined. Ion concentration at heights of 150 to 200 km is computed for both models with allowance for ion reactions in the excited state. (auth)

33424 ELECTRIC FIELDS AND CURRENTS IN THE BOUNDARY REGION OF ELECTROJETS. Mal'tsev, Yu. P.; Leont'ev, S. V.; Lyatskii, V. B. (Polar Geophysical Inst., Kola, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 910-914(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1075-1080(1973).

Electric fields and equivalent currents are computed for a model of the high-latitude ionosphere with conductivity as a step function of latitude. It is demonstrated that the inflow of the westward electrojet behind the eastward electrojet is satisfactorily explained with the selected values of conductivity. (auth)

33425 SEMIANNUAL VARIATIONS IN AERONOMY AND GEOMAGNETISM. Ivano-Kholodnyi, G. S. Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 823-839(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 969-990(1973).

Various phenomena with semiannual variations (SAv) are reviewed. SAv are variations with a period of 6 months and when the maximum of a given quantity falls on equinoctial months, that is direct SAv and when the minimum falls on these months, that is inverse SAv. Axial and equinoctial hypotheses have been advanced to explain the SAv of geomagnetic disturbances. Phenomena associated with geomagnetic activity are discussed and some SAv recorded in meteorology are discussed. Density variations, temperature variations, variations in composition, and the sources of SAv of the upper atmosphere are parameters reviewed. Each region of the ionosphere is investigated separately and then the total amount of electrons is investigated. Winds and diffusion and airglow are other phenomena associated with SAv that were investigated. (201 references) (MCW)

33426 CHROMOSPHERE BURSTS AND SUDDEN COMMENCEMENTS OF GEOMAGNETIC STORMS. Nesmyanovich, A. T.; Nesmyanovich, E. I. Kosm. Issled. Ikr.; No. 3, 40-45(1973). (In Russian).

A catalog was made of burst activity in 1957-1967 (solar activity cycle). Comparison of all SC for the period with chromosphere bursts showed no correlation between the two phenomena. It was not possible to draw conclusions concerning the rate of dispersion of shock waves or solar plasma from the retardation time of SC relative to near bursts. Assumption of dispersion of shock waves throughout the hemisphere were not confirmed and were actually contradicted by the recurrence of SC. Between SC and the chromosphere sparks there is a correlation. SC were observed by shock waves or tangential explosions at the western boundary of the quasi-stationary corpuscular flux or at the boundary between sectors. (tr-auth)

33427 NIGHTTIME IONOSPHERE: E REGION AND LOWER F REGION. Strobel, D. F.; Young, T. R.; Meier, R. R. (Naval Research Lab., Washington, DC). J. Geophys. Res.; 79: No. 22, 3171-3178(1 Aug 1974).

Detailed numerical calculations for the nighttime ionosphere are performed to evaluate the quantitative importance of nighttime radiation fields. Models for the intensities of night sky H I 1216, H I 1026, He I 584, and He II 304-Å radiation are presented, and the production rates of ion species are calculated. The intensity of the Lyman α and Lyman β radiation fields from terrestrial and extraterrestrial sources is sufficient to maintain the nighttime lower ionosphere at observed electron density levels. Analysis of ion composition data indicates that on winter anomalous days of D region ionospheric absorption the E region is substantially depleted of NO molecules. (auth)

33428 ANGULAR DISTRIBUTION OF SPREAD F RETURNS FROM AN ARTIFICIALLY MODIFIED IONOSPHERE. Allen, E. M.; Thome, G. D.; Rao, P. B.; St. Germain, R. L. (Raytheon Co., Sudbury, MA). J. Geophys. Res.; 79: No. 22, 3161-3169-(1 Aug 1974).

A 32-element HF-phased array was used to study the angular spectrum of spread F returns from an ionosphere modified by the powerful radio frequency heater transmitter at Platteville, Colorado. The diagnostic radar is a coherent pulse system that provides an angular resolution of 2.7° at the midband frequency of 7.5 MHz, a range resolution of 30 km, and a Doppler resolution of 0.08 Hz. The results are presented in the form of sky maps (brightness versus azimuth and elevation) of the returns as a function of group delay, Doppler shift, polarization, and sounding frequency. The principal result is that the returns that suffer the greatest group delay at a given sounding frequency come from a direction looking up the earth's magnetic field and exhibit negative Doppler shift. Ray-tracing simulation of the observed dependence of the range and the Doppler on the angle of arrival of the returns supports the view that the heater-generated spread F is caused by field-aligned ducts produced within the heated volume. A simulation run for Arecibo, Puerto Rico, in comparison with that for Platteville, reveals that the group delay spread is about the same, and the angular spread is approximately in the same ratio as the heater beam widths at the two locations. (auth)

33429 CHEMICAL EXCITATION OF $O_2(^1\Delta_g)$ IN AURORAS. Swider, W. (Hanscom Air Force Base, Bedford, MA). J. Geophys. Res.; 79: No. 22, 3221-3224(1 Aug 1974).

If about 50% of the O_2 is left in the $^1\Delta$ state, the reaction $O_2^+ + NO \rightarrow NO^+ + O_2$ may generate as much $O_2(^1\Delta)$ in an aurora as electron impact of O_2 by secondary electrons (Cartwright et al., 1972). Together, these processes may yield approximately one $O_2(^1\Delta)$ molecule per ion pair formed in the aurora. Stimulated emission of 1.27-μ radiation by electron collisions with the normal $O_2(^1\Delta)$ nightglow layer is seen as a copious but improbable source of 1.27-μ emissions in auroras. The importance of the temporal history and of the temperature for auroral generated $O_2(^1\Delta)$ is briefly discussed. (auth)

33430 VALIDITY AND COMPARISON OF VARIOUS METHODS OF ANALYSIS OF IONOSPHERIC DRIFT RECORDS FOR AN EQUATORIAL STATION. Misra, R. K. (Swair Vihar Society, Ahmedabad, India). J. Geophys. Res.; 79: No. 22, 3225-3228-(1 Aug 1974).

A few closely spaced receiver ionospheric drift records for an equatorial station in the Indian zone (Thumba, 0.6°S dip) are

subjected to various methods of analysis proposed by different workers from time to time. It is shown that the modified time delay method of Bamgboye et al. offers a good substitute for the full correlation analysis for an equatorial station like Thumba when a complete knowledge of the ground diffraction pattern is to be derived from the time shifts alone. The methods proposed by Pütter and Banerji are not applicable to an equatorial station owing to the extreme elongation of the irregularities in the magnetic north-south direction. The variant 2 method results for both V and V_c show a close correspondence with those of the full correlation analysis even for regions of extreme anisotropy like Thumba. (auth)

33431 THREE-DIMENSIONAL STATISTICAL ANALYSIS OF IONOSPHERIC DRIFT RECORDS FOR AN EQUATORIAL STATION. Misra, R. K. (Swair Vihar Society, Ahmedabad, India). J. Geophys. Res.; 79: No. 22, 3229-3230(1 Aug 1974).

Results of the three-dimensional analysis for the ionospheric irregularities in the F region over Thumba is given for a few cases. It is found that the three-dimensional statistical method of analysis gives more consistent results than the two-dimensional method for all the parameters of drift and of anisotropy of the irregularities and also gives additional information on vertical drift and the third axis of the ellipsoid. (JFP)

33432 ESTIMATION OF ELECTRON COLLISION FREQUENCY IN THE LOWER THERMOSPHERE. Ganguly, S. (Univ. of Calcutta). J. Geophys. Res.; 79: No. 22, 3235-3238(1 Aug 1974).

Attempts were made to estimate the height distribution of the electron collision frequency in the lower thermosphere from simultaneous observations of the frequency dependence of both real (ionogram data) and imaginary (A_I absorption data) parts of the height-integrated complex refractive index. The method is essentially a process of trial and error in which the observed experimental values are matched with those derived from the proposed models. Good agreement is observed between the derived values of collision frequencies and those inferred from purely gas kinetic considerations. Further, the collision frequencies at E region heights are found to increase considerably with solar activity level. The collision frequencies at F region heights, on the other hand, undergo considerable day to night variation, nighttime values being consistently higher than those during the daytime. (auth)

33433 EFFECT OF UNCERTAINTIES IN RATE COEFFICIENTS ON DENSITIES OF E REGION SPECIES. Myers, B. F.; Hamlin, D. A.; Schoonover, M. R.; Valerio, J. I. (Science Applications, Inc., La Jolla, CA). J. Geophys. Res.; 79: No. 22, 3239-3242(1 Aug 1974).

A direct statistical method was applied to determine the effect of uncertainties in rate coefficients on computed densities of E region species. Uncertainties in rate coefficients are described in terms of Gaussian error law distributions with a common fractional standard deviation. Mean densities are found to be relatively insensitive to rate coefficient uncertainties; fractional standard deviations of density distributions are, in general, less than twice those associated with rate coefficient distributions, provided the fractional standard deviations of the rate coefficient distributions are not greater than 0.45. (auth)

33434 ALBEDO AND IONIZATION OF THE UPPER LAYERS OF THE ATMOSPHERE. Sokolov, V. D.; Skryabin, N. G. Kosm. Luchi; No. 14, 54-56(1974). (In Russian).

The problem of the F2 layer residual night ionization is considered. The authors set forth their own hypothesis of the mechanism and sources of the residual night ionization of this layer. (auth)

33435 INFLUENCE OF PRECIPITATIONS LOCAL STRUCTURE ON SPECTRAL CHARACTERISTICS OF BREMSSTRAHLUNG X-RADIATION. Kuz'min, I. A.; Lazutin, L. L. Kosm. Luchi; No. 14, 117-119(1974). (In Russian).

The article presents a continuation of the work on modeling, using statistical (Monte Carlo) method of tests of the pass of the bremsstrahlung x-radiation from auroral electrons for the local penetration occasion. The previously described model of the bremsstrahlung x-radiation pass was used for the calculations, the input parameters having been varied. The electron penetration was assumed to occupy an infinite band 5 km wide. The passing of the particles has been studied in relation to the depth in the atmosphere as well as in relation to the distance from the penetration center. A conclusion is drawn that the parameters of the radiation as measured in the stratosphere essentially depend upon the spatial structure of the auroral electron penetration region and upon the spatial position of the detector. (auth)

33436 SPECTRUM OF PRIMARY COSMIC RAYS WITH THE ENERGY BELOW 15 TO 20 GeV. Skryabin, N. G.; Sokolov, V. D. Kosm. Luchi; No. 14, 96-98(1974). (In Russian).

The primary cosmic ray spectrum is defined from the data obtained through measurements in the stratosphere; data of measurements beyond the magnetosphere boundaries where the primary radiation is not transformed and where albedo particles are not available have also been turned to account. (auth)

33437 RAY TRACING TREATMENT OF THE OBLIQUE ECHO MODEL FOR THE TOPSIDE UPPER HYBRID RESONANCE. Parkes, E. J. (Univ. of Strathclyde, Eng.). J. Plasma Phys.; 12: No. 1, 107-127(Aug 1974).

The oblique echo model for the resonance near the local upper hybrid frequency f_T observed by topside sounders involves the propagation of slow waves away from the sounder, which later return as echoes after reflexion due to an electron density gradient. The model is investigated by using ray tracing techniques. Use of Poeverlein constructions gives some idea as to the qualitative nature of the rays which contribute to the resonance. A quantitative description requires the use of ray-trajectory equations. By using a simple approximate warm electromagnetic dispersion relation (which, nevertheless, retains all the important features of the exact dispersion relation), the ray-trajectory equations are integrated analytically for the case of a stratified plasma with a linear density gradient. These equations are used to investigate the behavior of the frequency of the received echoes as a function of delay time. The resonance exhibits strikingly different characteristics for $f_T < 2f_H$ and $f_T > 2f_H$ respectively, where f_H is the electron gyrofrequency. For $f_T < 2f_H$ the resonance is "strong", the receiver observing a continuous response consisting of two echoes which interfere to give a fringe pattern. Some typical ray paths are illustrated. For $f_T > 2f_H$ the resonance is "weak" and without fringes. A condition is derived for the existence of intercepting ray paths and for the maximum time delay that occurs when they do exist. (auth)

33438 CHARACTERISTICS OF RADIO AURORA OCCURRENCES OBSERVED AT SYOWA STATION IN ANTARCTICA. Shiro, I. (Radio Research Lab., Koganei, Japan); Sakamoto, T. Denpa Kenkyusho Kiho; 19: No. 104-105, 421-436(Jun 1974). (In Japanese).

Radio auroral echoes at 112 MHz observed at Syowa Station, the Antarctic, for nearly one year from April, 1970, till February, 1971, were analyzed to investigate their characteristics of occurence. Results obtained are summarized as follows: The diurnal variation in the frequency of the radio echo occurrence correlates well with that in the magnetic Q-index. The occurrence frequency for the morning section correlates comparatively well with absorption of the cosmic radio noise recorded by the riometer, but no definite relation is found in the evening section. Through each hourly zone during the whole months of June and October, the ratio of the occurrence frequency of E_s accompanied with the radar echoes to that of the whole E_s is a little larger than about 30% on the average. The hourly averages of the critical frequency of E_s accompanied with radar echoes are generally larger than those of the whole E_s. There seems to be no correspondence between the type of E_s's and the appearance of radar echoes. The product of fE_s and geomagnetic variation (γ) at that time gives a good index for the appearance of auroral echoes. This fact implies that ionization irregularities effective for producing auroral echoes are influenced by the electric field in the E_s layer. Most echoes in the dark winter have discrete structures, while those in the sunlit summer are characterized by diffuse ones. The reflected echoes are generally weaker in winter than in summer. The echoes in winter are confined within the range from 300 to 400 km, while the range of those in the summer extends from 300 to 1100 km. Radio auroras move at a speed of 500 to 600 m/s northward in the morning and southward in the evening. (auth)

33439 EFFECT OF SHORT BURSTS OF COSMIC X- AND γ-RAYS ON THE IONOSPHERE. Baird, G. A. (University Coll., Dublin). J. Atmos. Terrest. Phys.; 36: No. 9, 1565-1569(Sep 1974).

The effect on the ionosphere of the recently discovered short bursts of X- and γ-rays is calculated. It is shown that bursts of the intensity reported so far are incapable of significantly affecting the ionosphere. (auth)

33440 MOTIONS OF PEAKS IN IONOSPHERIC AURORAL ABSORPTION AND AURORAL INFRASONIC WAVES. Wilson, C. R. (Univ. of Alaska, College); Hargreaves, J. K. J. Atmos. Terrest. Phys.; 36: No. 9, 1555-1560(Sep 1974).

The average direction of motion of "peaks" in ionospheric auroral absorption events changes with local time in a manner

similar to that of the direction of propagation of auroral infrasonic bow waves (AIW) as observed in the auroral zone. A study of the morphology of motions of auroral absorption peaks can thus give information on the variation with local time of the motion of auroral arcs that generate AIW. (auth)

33441 GENERAL RELATIONS FOR RESONANT PARTICLE DIFFUSION IN PITCH ANGLE AND ENERGY. Lyons, L. R. (National Oceanic and Atmospheric Administration, Boulder, CO). J. Plasma Phys.; 12: No. 1, 45-49(Aug 1974).

By applying quasi-linear diffusion theory, general expressions are obtained for particle diffusion coefficients in both pitch angle and energy. The results are valid for resonant interactions with any mode of weak plasma turbulence, with wave energy distributed over any range of frequencies and wave normal angles. Simple relations are found between the diffusion coefficients, these relations reflecting the geometry of the diffusion surfaces for resonant particles. (auth)

33442 GEOMAGNETIC SOLAR FLARE EFFECT OF 3 MAY 1973 AT INDIAN STATIONS AND ITS DEPENDENCE ON THE COUNTER-ELECTROJET. Srivastava, B. J. (National Geophysical Research Inst., Hyderabad, India). J. Atmos. Terrest. Phys.; 36: No. 9, 1571-1575(Sep 1974).

An unusually large solar flare effect was recorded at the Hyderabad magnetic observatory on 3 May 1973. The amplitude of the maximum deviation of H at Hyderabad was the highest recorded since the establishment of the observatory in December 1964. The SFE was caused by an optical solar flare of importance 3B. The relevant magnetograms of all the six magnetic observatories in India lying between the longitudes of 72°E and 80°E have been examined and the results of the study are presented and discussed. Three of the observatories are within the influence of the equatorial electrojet, and the records from these stations show a reduction of the H-amplitudes compared with the records from the remaining stations. The reduction is attributed to a counter-electrojet flowing from east to west in the E-region over the dip equator in extreme south India at the time of the SFE. Reasons are given. (UK)

33443 SOLAR-TERRESTRIAL DISTURBANCES OF AUGUST 1972. XI. Observation of Faraday Rotation. Nakata, Y.; Kan, M.; Nemugaki, R.; Koizumi, T.; Okamoto, S. (Radio Research Lab., Koganei, Japan). Denpa Kenkyusho Kiho; 19: No. 103, 337-340(Jul 1973). (In Japanese).

Presented are the results of Faraday rotation for Syncom 3 at Wakkanai and Kokubunji and for ATS 1 at Kokubunji. Further, the equivalent slab thickness and the ratio of upper and lower electron contents for Syncom 3 at Kokubunji are discussed. (auth)

33444 SOLAR-TERRESTRIAL DISTURBANCES OF AUGUST 1972. XII. Anomalous Propagation of vhf Waves in the Trans-Equatorial Paths. Yamaoka, M.; Tanohata, K.; Tsuchiya, K. (Radio Research Lab., Koganei, Japan). Denpa Kenkyusho Kiho; 19: No. 103, 341-351(Jul 1973). (In Japanese).

It is well-known that radio waves in the VHF band show peculiar propagational characteristics for trans-equatorial paths nearly along the geomagnetic meridian owing to specific structures of the equatorial ionosphere. Radio waves in the VHF band transmitted at Darwin (48, 72, 88 and 102 MHz), Adelaide (32 MHz) and St. Kilda (4 ~ 64 MHz path sounder) were received at Yamagawa and Wakkanai (32 MHz only) Radio Wave Observatories located on the trans-equatorial paths. Effects of disturbances in August 1972 upon the signal strength and the maximum observed frequency (MOF) of the trans-equatorial propagation (TEP) waves were examined. Post SID increases in the signal strength of TEP waves at 32 MHz received at Yamagawa were observed on the occasions of two major flares on August 2 and 4 and two small flares on August 3 and 7. The TEP waves at the frequencies up to 102 MHz were frequently received in the nighttime during the disturbed period. (auth)

33445 PERIODIC VARIATIONS IN GEOSTATIONARY SATELLITE POLARIZATION OBSERVATIONS. Webster, A. R.; Lyon, G. F. (Western Ontario Univ., London). Ann. Geophys.; 29: No. 1, 103-110(Jan 1973).

The results of continuous polarization angle measurements on the 137 MHz transmission from the geostationary satellite ATS-3 over a one-month period are presented. The occurrence of quasi-periodic variations in the order of a few percent of the total rotation and in the frequency range 0.5 to 4 c/hour is looked at in some detail. The results indicate a trend towards larger amplitudes for lower frequencies (longer period) with the suggestion of preferred frequencies near 1 c/hour in contrast to previously reported enhancement in the region of 2.5 c/hour. Predicted observational biases do not seem to affect the results in the expected manner. The fluctuations show good correlation (but shifted in time) with magnetic activity at the low end of the frequency spectrum, but little correlation at the high end. (FR)

33446 SOLAR-TERRESTRIAL DISTURBANCES OF AUGUST 1972. VIII. General Feature of Ionospheric Disturbances Appeared Vertical Sounding. Koizumi, T.; Ohyama, H.; Hiidome, S.; Echizenya, Y. (Radio Research Lab., Koganei, Japan). Denpa Kenkyusho Kiho; 19: No. 103, 305-321(Jul 1973). (In Japanese).

General features of the ionospheric disturbances associated with the outstanding solar geophysical August event are presented for the period from 1st to 10th August, 1972, at Japanese Ionospheric Stations. It was found that the disturbances were divided into three groups of 4th to 5th, to 7th, and 9th to 10th, corresponding to the geomagnetic storms. Among these, the first group of disturbances is the most outstanding and contains a series of peculiar oscillation periods of about 2.5 hours in the daytime showing f_0F2, h'F2 and N(h) profiles. (auth)

Magnetospheric Phenomena

Refer also to abstracts 33129, 33286, 33425, and 33442.

33447 (AD-775168) GEOMAGNETICALLY TRAPPED ALPHA PARTICLES. Low-Altitude Outer-Zone Alpha-Proton Comparisons. Report for November 1972-April 1973. Fennell, J. F.; Blake, J. B.; Paulikas, G. A. (Aerospace Corp., El Segundo, Calif. (USA)). 15 Jan 1974. Contract F04701-73-C-0074. 40p. (SAMSO-TR-74-24). NTIS $3.25.

The outer-zone population of trapped alpha particles and protons was measured off the equator ($B/Bo \approx 1.3-2.3$) in the L interval $2 \leq L \leq 4$ during 1969. The alpha-particle spectra are best represented by a power law with spectral indices between 2.4 and 4.0 over the energy range $0.85 \leq E_\alpha \leq 9.0$ MeV. The alpha-particle and proton spectra have the same slope at the same total energy. The distribution functions for alpha particles and protons have similar shapes and they suggest that the location of the source of these particles is at $L > 4$. The proton pitch-angle distribution at small pitch angles is flatter than near the equator. It is suggested that pitch-angle scattering may be the primary source of the low-altitude ions. The measurements are compared with recent theoretical predictions. (GRA)

33448 (AD-777168) RESONANT ALFVÉN WAVES IN A DIPOLE MAGNETIC FIELD. Report for August-December 1973. Chiu, Y. T. (Aerospace Corp., El Segundo, Calif. (USA)). 19 Mar 1974. Contract F04701-73-C-0074. 33p. (SAMSO-TR-74-61). NTIS $3.25.

The general problem of determining the plasma density distribution in a dipole magnetic field by means of the characteristics of resonant Alfvén waves is discussed in terms of the theory of Hill's differential equation. It is shown that for a spectrum of power-law plasma density models the vector wave equation for resonant Alfvén waves, guided along field lines of a static dipole magnetic field, can be solved exactly in terms of mathieu functions. (auth)

33449 (AD-777576) PARTICLE LIFETIMES IN STRONG DIFFUSION. Schulz, M. (Aerospace Corp., El Segundo, Calif. (USA)). 31 Mar 1974. Contract F04701-73-C-0074. 19p. (SAMSO-TR-74-75). NTIS $3.00.

The mean lifetime τ of a particle distribution, driven to isotropy by intense pitch-angle diffusion, is calculated by analytical means for conditions applicable to the earth's magnetosphere. Distinction is made in the full expressions for τ between complete isotropy (caused by strong pitch-angle diffusion all along the field line) and incomplete isotropy (caused by strong diffusion that is localized at the magnetic equator) over the upward hemisphere in velocity space. (auth)

33450 (AD-777812) CONJUGATE MAGNETOSPHERIC TRANSMISSIONS AT VLF FROM ALASKA TO NEW ZEALAND. Report for July 1972-August 1973. McPherson, D. A.; Koons, H. C.; Dazey, M. H.; Dowden, R. L.; Amon, L. E. S. (Aerospace Corp., El Segundo, Calif. (USA)). 15 Apr 1974. Contract F04701-73-C-0074. 20p. (SAMSO-TR-74-90).

A very-low-frequency (vlf) magnetospheric transmission experiment was conducted between Port Heiden, Alaska and Dunedin, New Zealand during August, 1972. Port Heiden is on an L-shell of 2.9 and is located 174-km geomagnetic north and 110-km geomagnetic east of the conjugate point for Dunedin. Whistler signals generated by the transmitter were detected at Dunedin for frequencies 6.8 and 21 khz. The data show: strong fluctuations in whistler amplitude over time periods of seconds, a relatively even distribution of amplitudes over a 10 db range, and a weak dependence of amplitude on pulse length with the maximum in-

tensity occurring for 0.2 to 0.4 sec pulse length. These characteristics are consistent with the concept that the waves are amplified by means of the doppler shifted cyclotron resonance with energetic electrons. (auth)

33451 (N-74-20467) STUDIES OF THE STRUCTURE OF THE PLASMASPHERE AS SEEN BY RADIOSOUNDER MEASUREMENTS ABOARD THE ALOVETTI-SATELLITE. Final Technical Report. Banks, P. M.; Doupnik, J. R. (California Univ., La Jolla, San Diego (USA)). 13 Nov 1973. 74p. (NASA-CR-137371). NTIS $6.75.

The structure of the plasmasphere was studied as seen by radiosounder measurements aboard the Alovetti-2 satellite. Magnetic tape data files were obtained from the NASA Ames Research Center to give a reasonably complete set of high latitude electron density profiles. Considerable effort was expended to develop models of ion flow in the topside ionosphere. These models took both H(+) and O(+) into account and permitted various parameter studies to be made of the various factors which affect H(+) escape in polar wind flows. The results of these studies are included. Extensive computer programs were written to display the measured electron density profiles in ways useful to geophysical analysis. The expected mid-latitude trough was easily discernible in the nighttime ionosphere at locations expected from similar observations of the plasmapause. In the dayside ionosphere, however, it proved extremely difficult to find any trough-like phenomena. Using the previously developed computer models, it was possible to study the region where the plasmapause appeared to be absent. It was found that over much of the dayside, large fluxes were computed well inside the plasmapause extending down to L-shells as low as 2.5. (auth)

33452 (N-74-21406) ANOMALOUS COSMIC-RAY ANISOTROPY AND UNIDIRECTIONAL INTERPLANETARY MAGNETIC FIELD DURING 1954. Antonucci, E. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Sep 1973. 20p. (NASA-CR-137417; SU-IPR-542). NTIS $4.00.

Observations of the interplanetary magnetic field during solar minimum lead to the following important conclusions for cosmic-ray modulation: the interplanetary magnetic field does not show any sector structure for a few solar rotations and cosmic-ray diffusion in the interplanetary medium is essentially anisotropic for rigidity. If diffusion occurs essentially along the magnetic-field lines, the cosmic-ray density U(r,T) is a summetric function of the heliolatitude lambda with a minimum in the equatorial plane. Therefore a cosmic-ray density gradient across the solar equatorial plane exists and it depends on the size of the modulation region. Only if a unidirectional magnetic field is present and if the Earth is outside the symmetry plane of the density function, i.e. the solar equatorial plane, the gradient is detected, over a long-term period, as a diurnal variation, with the direction of the maximum perpendicular to the interplanetary magnetic field. (auth)

33453 (N-74-22425) COSMIC RAY STUDIES ABOARD ARTIFICIAL EARTH SATELLITES. Grigorov, N. L.; Akimov, V. V.; Nesterov, V. E.; Rapoport, I. D.; Kalinkin, L. F.; Volodichev, N. N.; Kiknadze, I. N. May 1974. Translated from pp 1-172 of Izuchenie Kosmicheskikh Luchey na Iskusstvennykh Sputnikakh Zemli, Nauka Press, Moscow, 1973. 230p. NTIS $14.50.

Specific investigations in the field of cosmic-ray physics are reported that were performed using artificial Earth satellites. The major portion of the collection is made up of articles presenting the results of experiments made aboard the Proton 1, 2, 3 scientific space stations (measurements of hydrogen and carbon effective interaction sections, energy spectrum of primary cosmic-ray particles of high and superhigh energies, study of the chemical composition of cosmic rays and high-energy electron fluxes in near-Earth cosmic space). Methodological questions of cosmic-ray study aboard artificial Earth satellites are included. (auth)

33454 TWO ASTROPHYSICAL APPLICATIONS OF KINETIC THEORY; JET STREAM FORMATION THROUGH INELASTIC COLLISIONS: PLASMA OSCILLATIONS IN THE MAGNETOSPHERE. Baxter, D. C. San Diego, CA; Univ. of California (1974). 96p. University Microfilms Order No. 74-17,702.

Thesis (Ph. D.).

A Boltzmann-type equation is used to examine the effects of inelasticity on scattering between particles in Kepler orbits. A Fokker–Planck equation is found which predicts either radial clustering or diffusion. The observation and analysis of oscillations with periods of hundreds of seconds in the magnetospheric plasma at 6.6 earth-radii, observed with the UCSD plasma experiment on the ATS 5 satellite are discussed. (Diss. Abstr. Int., B)

33455 ENERGETIC ELECTRONS IN THE NEAR GEOMAGNETIC TAIL AND AT SYNCHRONOUS ORBIT: SPATIAL DISTRIBUTIONS AND ACCELERATION MECHANISMS. Walker, R. J. Los Angeles; Univ. of California (1973). 133p. University Microfilms Order No. 74-11,589.

Thesis (Ph. D.).

The results of a study of the energetic (E > 50 keV) electron population in the near geomagnetic tail and a model for the acceleration of outer radiation zone electrons are presented. Energetic electron data and magnetic field data from the UCLA electron spectrometer and fluxgate magnetometer experiments on OGO-5 formed the basis for the study of the magnetotail electrons. (Diss. Abstr. Int., B)

33456 THEORY OF MAGNETIC PULSATIONS. Hasegawa, A.; Chen, L. (Bell Telephone Labs., Inc., Murray Hill, NJ). Space Sci. Rev.; 16: No. 3, 347-359(Sep 1974).

Theory of long period (pc 3 to pc 5) magnetic pulsations is presented. It consists of two parts; one (called type A) deals with a resonant Alfvén wave excitation at a local field line by a monochromatic wave generated at the magnetopause, and the other (called type B) deals with an excitation of a surface eigenmode by an externally applied impulse at a location with a rapid spatial change of plasma parameter(s). For the type A pulsations, the theory gives the frequency, the sense and the ellipticity of the polarization and the orientation angle of the major axis as a function of the magnetospheric parameters. In particular, it is shown that the orientation angle of the major axis of the polarization ellipse is a sensitive function of the direction of the wave propagation in longitude and the change of the number density and the magnetic flux density in the radial direction, hence it can be used as an important diagnostic parameter. In the type B pulsations, the theory gives the excitation frequency and the damping rate of the pulsations using the derived surface eigenmode. Example of an application to the observed magnetic field oscillations at the plasmapause is presented in which the observed frequency and the damping rate are used to estimate the plasmapause density and its radial density gradient. (auth)

33457 DIAGNOSTICS OF THE MAGNETOSPHERE AND INTERPLANETARY MEDIUM BY MEANS OF PULSATIONS. Gul'elmi, A. V. Space Sci. Rev.; 16: No. 3, 331-345(Sep 1974).

The possibility of diagnostics of the interplanetary magnetic field using the data of ground observations of Pc3, 4 pulsations is investigated. Both empirical and theoretical foundations of this method are discussed. In the shorter-period range (Pc1, Pi1, Ipdp) the methods of qualitative diagnostics of nonstationary processes in the quiet and disturbed magnetosphere are considered. In conclusion, the problems, arising when estimating the amplitude of the hydromagnetic waves in the regions of generation are considered briefly. (auth)

33458 CONSEQUENCES OF MICROPULSATIONS ON GEOMAGNETICALLY TRAPPED PARTICLES. Thorne, R. M. (Univ. of California, Los Angeles). Space Sci. Rev.; 16: No. 3, 443-458 (Sep 1974).

Nonadiabatic radiation belt dynamics is largely controlled by interactions between geomagnetically trapped particles and various modes of plasma turbulence. Long period electric field fluctuations act as a major source mechanism for the inner zone through the process of inward radial diffusion of particles injected into the convection dominated outer zone. Higher frequency turbulence provides a major loss mechanism by pitch-angle scattering into the atmospheric loss cone. The wave particle interaction may take the form of self induced instabilities or parasitic scattering. Examples of each will be given in this review. (auth)

33459 WAVE-PARTICLE INTERACTIONS BETWEEN THE RING CURRENT PARTICLES AND MICROPULSATIONS ASSOCIATED WITH THE PLASMAPAUSE. Nambu, M. (Kyorin Univ., Tokyo). Space Sci. Rev.; 16: No. 3, 427-442(Sep 1974).

The drift-wave instabilities likely to occur at and near the plasmapause during the period of magnetospheric disturbances are described. The analysis predicts that the proton cyclotron drift loss-cone wave (non-flute electrostatic mode) grows at and near the plasmapause through the drift cyclotron resonant interactions of the ring current protons. The wave is particularly effective for the turbulent loss of the ring current protons just beyond the plasmapause. In a region just inside the plasmapause, the wave is likely to be stabilized by the Landau interaction of the plasmaspheric particles. The unstable wave propagates in opposite directions inside and outside the plasmapause. Accordingly, the proton precipitation pattern would be different in respective regions. The unified loss mechanism of the ring current protons is presented. It is suggested that an ordinary mode instability occurs through the drift resonant interactions with the ring cur-

rent electrons far beyond the plasmapause. This wave is excited only in a high-β plasma with the conditions that the electron temperature perpendicular to the magnetic field is greater than the parallel temperature and that the temperature gradient has an opposite sign to that of the number density and magnetic field. The frequency and wavelength of the fastest growing wave depend sharply on the temperature anisotropy as well as the strength of the inhomogeneities (in temperature, magnetic field and number density). The fastest growing wave has a period of ≈36.9 s under certain conditions. This wave is likely to be an origin of the pitch-angle diffusion of the ring current electrons. (auth)

33460 RECENT STUDIES IN MICROPULSATION THEORY. Southwood, D. J. (Imperial Coll. of Science and Tech., London). Space Sci. Rev.; 16: No. 3, 413-425(Sep 1974).

Three recent studies in the theory of micropulsations are described. Attention is given to the behavior of the signal below the magnetosphere in the ionosphere and atmosphere, to the field line resonance problem and to hot plasma effects on magnetospheric hydromagnetic waves. In each case recent relevant observations are discussed. (auth)

33461 INTERRELATION BETWEEN VLF AND ULF EMISSIONS. Kimura, I. (Kyoto Univ.). Space Sci. Rev.; 16: No. 3, 389-411(Sep 1974).

Observations and theoretical works so far made are reviewed in regard to the interrelation of VLF and ULF emissions. Quasi-periodic VLF emissions are one of the typical examples showing the interrelation between the two phenomena. The term "modulation" may be more appropriate to explain these phenomena. Tentative interpretations will be given of the VLF and ULF emissions which are closely associated through a modulation of the electron distributions. (auth)

33462 NONLINEAR EFFECTS IN THE ELF WAVES PROPAGATING ALONG THE MAGNETIC FIELD IN THE MAGNETOSPHERE. Karpman, V. I. (Inst. of Terrestrial Magnetism, Ionosphere, and Radiowave Propagation, Moscow). Space Sci. Rev.; 16: No. 3, 361-388(Sep 1974).

Nonlinear theory of ELF waves propagating along the magnetic field in the magnetosphere is reviewed. The following subjects are covered: (1) main peculiarities of the quasilinear approximation. (2) Nonlinear interaction of monochromatic waves with the resonant particles. (3) Side-band instability. (4) Quasimonochromatic wave packets. (5) Effects due to the inhomogeneity of the medium. (auth)

33463 RADIATION FROM SOURCES MOVING IN A WARM MAGNETOPLASMA. Baker, D. J. Ann Arbor, MI; University of Michigan (1973). 228p. University Microfilms Order No. 74-15,663.

Thesis (Ph. D.).

The power lost through radiation by an electric charge as it spirals in a homogeneous magnetoplasma is calculated. Coherent Cherenkov radiation from a group of charges is studied by assuming the charges radiate as a single macroscopic ellipsoid of revolution having a uniform volume charge density. The total power radiated by such a macroscopic source is shown to be finite even in those cases where the refractive index is unbounded. The power radiated by electric dipole and loop antennas oriented with their axes along the magnetic field of an anisotropic plasma and moving parallel to this field are given in the form of integrals which are easily evaluated numerically. Mathematical models of the plasma dielectric tensor are derived using kinetic theory in addition to using the so-called hydrodynamic and full adiabatic theories (models H and A, respectively) with allowances made for the finite temperatures of both ions and electrons. Numerical results obtained using models A and H are compared. For example, model A predicts that in some cases a large fraction of the power radiated by a moving point charge source at frequencies near the upper hybrid resonance is in the form of thermal mode excitation. However, this "high energy" thermal mode is missing from results obtained for the same source charge using model H. The radiation from the moving electric dipole antenna is shown to be a combination of ordinary dipole radiation and Cherenkov radiation. Both the electric dipole and loop antennas excite a band of frequencies when they are moving. Expressions for use in computing the power radiated by these antennas at the various Doppler shifted frequencies is given. Finally, some potential applications of the theory are described as well as suggestions for extending the present theory. (Diss. Abstr. Int., B)

33464 FINE STRUCTURE OF SOLAR-WIND VELOCITY DISTRIBUTION. Lotova, N. A.; Chashey, I. V. (Lebedev Inst. of Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 846-852(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 998-1005(1973).

A theory of analysis of the fine structure of solar-wind velocity is developed. Four models are examined: a model of an elongated medium, a model with a peculiar local turbulence, a model of a medium with a spatial velocity spectrum, and a model of a medium with random velocity dispersion. The characteristic features of the temporal velocity dispersion that distinguish the given model from the others are established by cross-correlation analysis. (auth)

33465 SOLAR-WIND THEORY. Shister, A. R. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 840-845(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 991-997(1973).

A model of supersonic solar-wind plasma flow from a rotating source is described in the framework of single-fluid hydrodynamics. Nonlinear effects determine the evolution of velocity, density, temperature, and magnetic field in space. The results of the theoretical analysis agree qualitatively with a number of experimental data. (auth)

33466 NONADIABATIC EFFECTS OF ELECTRON MOTION IN A DIPOLE TRAP. Il'ina, A. N.; Il'in, V. D.; Gavrilov, V. I.; Lobanov, Yu. N. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 869-871(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1025-1028(1973).

The results of measurements of the lifetime of electrons in a dipole trap are presented for two drift shells. The experiments support theoretical estimates of the trapping time of electrons in a dipole magnetic field. (auth)

33467 NORMAL AND ANOMALOUS GEOMAGNETIC FIELDS IN A MULTI-LAYERED MEDIUM. Zhdanov, M. S.; Berdichevskii, M. N. (Moscow Inst. of the Petrochemical and Gas Industry). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 940-944(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1110-1114(1973).

The method of separating the variable geomagnetic field into a normal and an anomalous part, developed for a homogeneous medium containing inhomogeneities, is extended to a multi-layer medium containing an arbitrary number of inhomogeneities. The method of converting the transverse electric part of the field to the lower half-space is described. (auth)

33468 GEOMAGNETIC FIELD AND ITS HARMONIC DESCRIPTION. Zmuda, A. J. (Johns Hopkins Univ., Silver Spring, MD). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 929-939(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1098-1109(1973).

The analytic description by spherical harmonics of the main geomagnetic field is applied to a number of geophysical problems. In order that results of various investigations may be readily compared, a reference field was adopted in 1968 by the IAGA. The background for this action is here briefly reviewed and the results of subsequent evaluations are treated. The limits to which the reference field should fit satellite and surface data are also discussed. Major problem areas are outlined, and recommendations for future studies are made. (auth)

33469 DISTRIBUTION OF THE INTENSITY OF Pc3-4 PULSATIONS ALONG THE GEOMAGNETIC MERIDIAN. Baranskii, L. N.; Plyasov-Bakunina, T. A.; Ramamudzhachari, K. R.; Sobolev, L. V.; Selivanov, V. I. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 924-928(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1092-1097(1973).

The results are reported of simultaneous Pc3-4 observations at 12 observatories located along the meridian $\Delta' \approx 130°$ in the interval $\Phi' = 7$-$74°$. The existence of a midlatitude maximum in the intensity distribution of Pc3 pulsations is confirmed, and a new maximum at $\Phi' = 70°$ is identified. The midlatitude maximum is typical of the noon hours and the high-latitude maximum of the morning hours of Moscow civil time (MCT). (auth)

33470 ESTIMATES OF ERRORS IN THE SPECTRAL ANALYSIS OF INDIVIDUAL D_{st}-VARIATIONS. Lagutinskaya, L. P.; Dubrovskii, V. G.; Rotanova, N. M.; Faynberg, E. B. (Inst. of Terrestrial and Atmospheric Physics, Ashkhabad, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 915-919(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1081-1086(1973).

The errors arising from the incorrect separation of aperiodic variations from the geomagnetic storm field are analyzed. The results indicate that daily S_q and S_D variations and errors in drawing the background line affect the total error. It is demonstrated that the error in the determination of the spectrum of the D_{st}-variation at frequencies $f \leq 0.5$ days^{-1} can be reduced to 10% by selecting the storm and the interval of geomagnetic latitudes characterized by a small ratio of S_D and D_{st} ampli-

tudes (≤ 0.5), using a special method to account for S_q. The advisability of using mathematical filtration of the high-frequency noise background is suggested. (auth)

33471 BOUNDARY DISCONTINUITIES AND MODELS OF FLOW AROUND THE MAGNETOSPHERE. Ivanov, K. G. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 905-909(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1069-1074(1973).

Attention is drawn to the fact that modern experimental data on the magnetic field allow for a model of a permanently open magnetosphere with an anisotropic contact discontinuity or a rotational discontinuity at the boundary. Plasma data do not preclude the existence of a surface magnetospheric flux, which follows from this model and has the same properties as expected at a contact or rotational discontinuity. (auth)

33472 DRIFT TRAJECTORIES OF ENERGETIC PARTICLES IN THE OUTER MAGNETOSPHERE. Alekseev, I. I. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 901-904(1973).

Translated from Geomag. Aeron.; 13: No. 6, 1064-1068.

Drift motions of charged particles in the outer magnetosphere are investigated. (auth)

33473 FORCE-FREE PULSAR MAGNETOSPHERE. I. The Steady, Axisymmetric Theory for the Charge-Separated Plasma. Okamoto, I. (Univ. of Manchester, Eng.). Mon. Notic. Roy. Astron. Soc.; 167: No. 3, 457-474(Jun 1974).

In the steady, axisymmetric theory of the pulsar magnetosphere with the charge-separated plasma the critical field line separating the region of negative charge from the region of positive charge must be a straight line parallel to the equator owing to the rigidity of the pulsar surface. Thus, the theory with the complete charge separation yields an unphysical field structure for the dipole condition or the split monopole at the surface. (auth)

33474 MAGNETOSPHERIC BOUNDARY DISCONTINUITY AND THE ELECTRIC FIELD IN POLAR CAPS. Ivanov, K. G. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 956-957(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1127(1973).

Formulation of the conditions at the magnetosphere boundary is followed for the theory of intramagnetospheric phenomena, in particular, for interpreting the observed properties of the electric field E in polar regions. The theory of the two-vortex structure of E in the ionosphere of polar caps is essentially confirmed by measurements. A considerable inhomogeneity in the distribution of the meridional component E_γ (solar magnetospheric coordinate) along the 6 to 18h LMT profile and its dependence on the interplanetary magnetic field F were recently observed: when F is directed away from the Sun along Archimedes' spiral in the Northern Hemisphere of the Earth, E_γ is nearly five times greater on the morning side of the cap than on the evening side, and in the Southern Hemisphere, E_γ is greater on the evening side; when the direction of F changes, these relationships become reversed. E_γ is always > 0; it is directed from morning to evening. These properties of E_γ are apparently simple consequences of the conditions at the boundary discontinuity of the magnetosphere if one proceeds from an open magnetosphere with a nonzero normal magnetic-field component at the boundary with a nonzero normal mass flow. (MCW)

33475 GEOMAGNETIC MICROBAYS. Litinskii, V. M.; Sedova, F. I. (Geophysics Inst., Lvov). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 957-958(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1128(1973).

Oscillations with periods T = 2 to 3 min were distinguished on recordings with a speed of 90 mm/hr at L'vov and Odessa. The minimum period of baylike disturbances were examined from 150 distinct oscillations with periods T ≤ 30 min (microbays) recorded for July-August 1971. The variations of the observations at the two posts are described and it can be postulated that the current systems are not identical. The preferred direction of the disturbance vectors of the microbays along the meridian can be better explained by DP2 than by DP1 current system. It is possible that microbays may be caused not only by independent current systems but also by fluctuations of other current systems. (MCW)

33476 EFFECT OF THE EAST-WEST COMPONENT OF THE INTERPLANETARY MAGNETIC FIELD ON MAGNETOSPHERIC CONVECTION AS DEDUCED FROM MAGNETIC PERTURBATIONS AT HIGH LATITUDES. Berthelier, A.; Berthelier, J. J.; Guerin, C. (CNRS, St. Maur, France). J. Geophys. Res.; 79: No. 22, 3187-3192(1 Aug 1974).

The variations of the horizontal and vertical components of the ground magnetic field at high latitudes are analyzed in order to separate the perturbations related to the east-west component B_γ of the interplanetary magnetic field from other perturbations. At invariant latitude $\Lambda_\gamma \geq 80°$ the perturbations of the vertical component are characterized by a daytime extremum that is maximum when B_γ is negative and minimum when B_γ is positive. This effect becomes inverted when $\Lambda_\gamma \leq 80°$ and disappears when $\Lambda_\gamma \leq 75°$. The currents that are equivalent to the additional horizontal perturbations due to the orientation of B_γ are maximum on the day side and follow a rather circular flow pattern, which in the southern hemisphere is westward in the case where B_γ is negative. In the northern hemisphere these average directions are reversed symmetrically. An asymmetric magnetospheric convection pattern may be deduced from these results. (auth)

33477 EFFECT OF THE STRUCTURE OF THE MAGNETOSPHERE ON THE BEHAVIOR OF THE PERIOD OF STEADY PULSATIONS. Kopytenko, Yu. A.; Raspopov, O. M. (Leningrad State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 13: No. 6, 920-923(1973).

Translated from Geomagn. Aeron.; 13: No. 6, 1087-1091(1973).

The periods of simultaneous type Pc4 pulsations at Borok and Lovozero during the IQSY are analyzed. A difference was found between the periods of synchronous pulsations in the Z-component, whose magnitude and sign depend on the magnetic disturbance level. Midlatitude Pc4 were identified along with high-latitude Pc4 (Pg). Midlatitude Pc4 were not observed at Lovozero. (auth)

33478 RESONANCE SCATTERING OF PROTONS ON CYCLOTRON INSTABILITY WAVES OF THE EARTH'S RADIATION BELTS. Beloshitskii, V. V.; Il'in, V. D.; Lobanov, Yu. N. Kosm. Luchi; No. 14, 113-114(1974). (In Russian).

Magnetic scattering of protons on the plasma's cyclotron instability waves in the Earth's radiation belts is discussed. (auth)

33479 LABORATORY MODELING OF MAGNETIC STORMS. Gavrilov, V. L.; Il'ina, A. N.; Lobanov, Yu. N. Kosm. Luchi; No. 14, 115-116(1974). (In Russian).

Interaction of a plasma flux with the magnetic field of a dipole was studied. (auth)

33480 NATURE OF CUTOFF RIGIDITIES IN THE REGIONS OF GEOMAGNETIC ANOMALIES. Smirnov, V. S.; Ustinovich, V. T. Kosm. Luchi; No. 14, 32-33(1974). (In Russian).

On the basis of the data obtained during the 2nd cruise of the RS "Academician Kurchatov" at the time when the ship navigated in the South African magnetic anomaly area, an attempt is made to single out this anomaly using six and nine terms of the magnetic field expansion in spherical harmonics. A conclusion is drawn that the spatial representation of the field in terms of spherical harmonics is not accurate enough, and that it is advisable to take account of the physical distribution of internal geomagnetic field sources for the numerical computations of the cutoff rigidities in the regions of magnetic anomalies. (auth)

33481 SOLAR-TERRESTRIAL DISTURBANCES OF AUGUST 1972. V. Solar Proton Events and Polar Cap Disturbances. Hakura, Y.; Ishii, T.; Asakura, T.; Terajima, Y. (Radio Research Lab., Koganei, Japan). Denpa Kenkyusho Kiho; 19: No. 103, 281-290(Jul 1973). (In Japanese).

Radio and x-ray characteristics of four major flares on August 2, 4, and 7, discussed in the preceding two papers, suggest that they were the very flares responsible for the giant interplanetary disturbances of August, 1972. The present paper examines the causality between these flares and proton events and the earth storms, by analyzing the data of proton fluxes and solar wind parameters obtained by the space probes IMP 5, 6, and Pioneer 9, and ground-based observations. Four pairs of proton events and interplanetary shock waves both at the earth and the Pioneer 9 were correlated with the four giant flares. Energy spectra of the earth-proton events and their time variations show that the first and the second events were of slow-onset type, devoid of high-energy protons, while the third and the fourth events were of fast-onset type and accompanied with cosmic ray increases at the ground level. Proton fluxes underwent considerable modulations in association with geomagnetic disturbances; in particular, an outstanding oscillation of proton fluxes was observed during eight hours after 21:00 UT on August 4, in the course of the second geomagnetic disturbance. Time variations in proton fluxes inside the earth's magnetosphere may also be described in terms of phase anomaly of VLF waves prop-

agating through the polar cap. The PCPA's (Polar Cap Phase Anomalies) that appeared on three VLF waves, NAA-17.8 kHz, GBR-16.0 kHz, and NPG-18.6 kHz, received at Inubo are discussed. (auth)

33482 SOLAR–TERRESTRIAL DISTURBANCES OF AUGUST 1972. VII. Vlf Emissions and Whistlers Observed During the Geomagnetic Storms. Ondoh, T. (Radio Research Lab., Koganei, Japan); Nishizaki, R.; Nagayama, M.; Tanaka, Y. Denpa Kenkyusho Kiho; 19: No. 103, 297-304(Jul 1973). (In Japanese).

Whistler-triggered emissions and a narrow band hiss were observed by ISIS-2 during the main phase ($K_p = 7_-$) of the geomagnetic storm of August 9, 1972, over Japan. Whistlers and their triggered emissions were observed only below L = 2.87 (Invariant latitude, $\Lambda = 53.8°$). A narrow band hiss with center frequency of 3.1–3.6 kHz and bandwidth less than 600 Hz lasted from L = 2.94 ($\Lambda = 54.3°$, $07^h46^m46^s$ UT) to L = 3.21 ($\Lambda = 56.1°$, $07^h47^m23^s$ UT). This narrow band hiss is very similar to those observed outside the plasmapause in a quiet period, and most whistlers and their triggered emissions occur usually inside the plasmapause; hence, it seems likely that the plasmapause lay around L = 2.94 ($\Lambda = 54.3°$) on the evening side (1717 LT) during the main phase of the August 9 geomagnetic storm. An empirical relation of $L_p = 5.64 - (1.09 \pm 0.22)\sqrt{K_p}$ between the plasmapause and K_p for the summer night gives $L_p = 2.86 \pm 0.56$ ($\Lambda = 53.8°$) for $K_p = 7_-$. This coincides approximately with the plasmapause position of L = 2.94 estimated from the low-latitude end of the narrow band hiss. Whistler occurrence rates (average number per minute) at Moshiri (geomag. lat. 34.3°N, long. 206.7°) are compared with K-indices at Memambetsu (34.0°, 208.4°) and f_0F_2 at Wakkanai (35.3°N, 206.0°) for August 3–13, 1972. The increases of the whistler rate generally occurred about 8–15 hours behind the corresponding increases of the K-index for August 3–13. The whistler rate increased suddenly at 15 UT on August 5, when f_0F_2 became very low (ionospheric storm), and the whistler-rate increase continued even during the daytime until 21 UT on August 6. For August 4–10, the whistler rate increased generally for 21–09 LT when f_0F_2 became low and spread F echoes occurred. Field-aligned irregularities of whistler ducts and spread F may be represented by $\Delta N/N$, where N denotes the ambient electron density, and ΔN, the irregularity. Since $\Delta N/N$ becomes large for low values of N, the whistler duct may be apt to be formed at times of low ambient electron density, such as an ionospheric storm or early morning. Consequently, it is concluded that abnormal increases of the whistler rate for August 4–10 were caused by formation of many whistler ducts associated with a redistribution of ionization in the disturbed plasmasphere. (auth)

PHYSICS (ATOMIC AND MOLECULAR)

Beams and Their Reactions

Refer also to abstracts 32306, 32317, 34040, and 34050.

33483 (CONF-730618-, pp 17-56) PRODUCTION OF INTENSE ION BEAMS WITH MODERATE CHARGE STATES. Gautherin, G.; Lejeune, C. (Univ. Paris, Orsay, France). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

The gas discharge sources were shown to be efficient to deliver important currents of multiply-charged ions of charge state $Z \leq 10$ when the discharge conditions are optimized by a proper choice of the operating and geometric parameters. These parameters effect all the properties of the source: intensity charge distribution, energy spectrum, instabilities and emittance. Their number is high in such magnetized discharges. Thus the logical improvement of the performance of the source needs a detailed analysis of the physical processes governing the discharge behavior and ion extraction. The problems posed by multiply-charged ion production are examined from this point of view. Technological problems will be mentioned only briefly as they are similar to those already solved for intense monocharged ion sources. The fundamental mechanisms leading to the equilibrium of a low pressure discharge used in ion sources are discussed: charge production and transport, arc conduction. In particular it is shown that a hot cathode discharge requires a minimum gas pressure for its existence. Below this minimum pressure the discharge is either converted into another form or is extinguished. This phenomenon is important as the arc conditions near the regime charge-over-point are favorable for multiply-charged ion production. However, the discharge may be no more quiescent: vibrations are set up affecting seriously ion beam focus. An elementary approach of the stepwise ionization in such discharges gives an approximate charge distribution in the ion beam; the operating conditions for optimizing a given moderate charge state are then derived. The previous conclusions are illustrated by a review of the experimental results concerning the performance of the most currently discharge sources now in use. (auth)

33484 (CONF-730618-, pp 155-162) TRIPLASMATRON: NEW POSITIVE AND NEGATIVE ION SOURCE. Aubert, J.; Gautherin, G.; Lejeune, C. (Univ. Paris, Orsay, France). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Previous studies in the laboratory allowed the demonstration of the existence of post-ionization in the expansion cup of the discharge of a duoplasmatron. The analysis of the discharge mechanisms led to a study of a new structure called "Triplasmatron." It essentially consists of a duoplasmatron with a large insulated expansion cup which is positively biased with respect to the anode; thus a discharge is created between the plasma expanding through the anode aperture of the duoplasmatron and the expansion cup walls. The duoplasmatron is used to supply the ionizing electrons to this auxiliary discharge: it acts as a "cathode." An elementary model for charge production and transport mechanisms in this four electrode structure was elaborated from the analysis of energy spectra of the extracted particles and electrostatic probe diagnostic of the discharge. A good interpretation of the emissive properties of the source is then derived. The major advantages of this new source are: the absence of pollution of the emissive cathode; the possibility to adapt the energy of the ionizing electrons to the wished collision processes; the possibility to heat the cup for metal ion production. The preliminary experiments were conducted with gases. As an example, in the case of oxygen, important intensities were obtained either of negative ions ($I_{\theta-} = 200\ \mu A$), singly-charged ions ($I_{\theta+} = 4$ mA; $I_{\theta 2+} = 10$ mA) or multiply-charged ions ($I_{\theta++} = 200\ \mu A$) with a reasonable dissipated power. (auth)

33485 (CONF-730618-, pp 168-173) FORMATION OF MULTIPLY CHARGED IONS IN ARC DISCHARGE OF MAGNETRON SOURCE. Zuk, W.; Maczka, D.; Wasiak, A. (Sklodowska Univ., Lublin). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

A magnetron ion source with a hot tungsten cathode as a filament drawn along source axis was used for ion implantation into semiconductors. The magnetic field of several hundreds oersteds was directed parallel to the cathode and the formed ion beam. The ion source construction assured good tightness of the ion source chamber as well as high efficiency, and enabled the ion production of non volatile elements. In order to increase the energy of ions implanted into the semiconductor elements as well as into the compounds of type $^{III}A^{V}B$, doubly charged ions Zn^{2+} and Cd^{2+} were used. If step ionization conditions in the arc discharge are ensured, doubly charged ion currents of an intensity sufficient for ion implantation can easily be obtained. In ion source work conditions which are still far from extremal, it was easy to obtain ion currents Zn^{2+} and Cd^{2+} of the order of 0.5 μA and stronger, i.e., quite sufficient for implantation purposes. The research performed proved that the doubly charged ion current quickly increases with the arc discharge current, as well as with the arc voltage. This increase is stronger for currents of doubly charged ions than for singly charged ones, and the graphs of the dependency of ion current rate Zn^{2+}/Zn^{+} or Cd^{2+}/Cd^{+} reveal curves similar to the straight line with a high slope to the anode current coordinate or that of the arc voltage. A discussion is given of optimal working conditions under which multiply charged ions can be obtained in the ion source; the mechanism of their creation is also subject to analysis. (auth)

33486 (GSF-P-44) INVESTIGATION OF THE ANISOTROPIC SPUTTERING OF HEXAGONAL METALLIC SINGLE CRYSTALS BY RARE GAS IONS IN THE ENERGY RANGE OF 10 TO 40 keV. Hofer, W. O. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany)). Jun 1972. 125p. (In German).

The contribution of focussing collision cascades for cathode sputtering of single crystals was investigated by measuring the spatial distribution of emission. For this, metal crystals of particular size are particularly suitable with a hexagonal structure of densely close packed structure. The first experiments on zinc single crystals proved to be very informative, however regarding the determination of possible focussons, showed disturbing side effects. The investigations were thus continued with magnesium. The emission characteristic of the following magnesium crystal surfaces were measured: (0001), (10(–1)0), (11(–2)0) and (36(–9)8). On all these planes, it can be seen that an always dominating random sputtering superposes the anisotropic emission. The half width of ⟨20(–2)3⟩ as well as the ⟨11(–2)0⟩ emission characteristic increases with decreasing ionic mass from Xe^{+} to Ne^{+}. A comparison between ⟨20(–2)3⟩ and ⟨11(–2)0⟩ emission distribution shows that the latter when bombarded with Xe^{+} has a 3° smaller half width i.e. a decrease of less than 20%. The temperature dependence of half widths is linear in the 100 K ($= T_{Kr}$)) = 370 K region, the gradient of the line is the same for the ⟨11(–2)0⟩ and ⟨20(–2)3⟩ emission distribution and has a value of 1.8°/100 K for Xe^{+} bombardment. For Ar^{+} bombardment the gradient is some 10% lower. Finally, for comparison, a few sputtering samples were investigated on a fcc crystal. A good agreement was found between the ⟨110⟩ emission of aluminium (111) plane and the ⟨11(–2)0⟩ sputtering of magnesium. Compared to gold ⟨110⟩ emission distribution, the half width value of Al ⟨110⟩ emission is wider by a factor of 1.8. (GE)

33487 (GSI-tr-12/74) PRACTICAL APPLICATION OF HEAVY ION BEAMS. Flerov, G. N.; Barashenkov, V. S. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). May 1974. 42p. (In German). INIS.

18 figs.; 1 tab.; 39 refs. Translation of the Russian report JINR-P14-7754.

Practical applications of heavy ion beams are discussed: ion implantation (manufacture of alloys, surface treatment, development of high-temperature conductors), study of radiation damage in reactor materials, manufacture of nuclear ultra filters of variable pore diameter, investigation of material surfaces by the analysis of the ion-excited characteristic x-radiation, radiotherapeutical treatment of malignant tumors, preparation of artificial isotopes. (GE)

33488 (KFKI-74-58) STUDIES ON A SIDENIUS (DANFYSIK-911) ION SOURCE. Kiralyhidi, L.; Pasztor, E.; Riedl, P. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

The experience gained from the installation of a Danfysik-911 ion source is reported. A modification in the extracting system has enabled a doubled starting current (e.g., 23 to 25 μA B^{11}) to be obtained. An emittance diagram of the source and mass spectrum of the ion beam is presented. (auth)

33489 (UCRL-Trans-1516) CONFINED HEAVY ION SOURCE: REVIEW OF ACTIVITIES. Arianer, J.; Baron, E.; Ton-That, T. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). Jul 1974. Translation by M. Martin of IPNO-RC-73-04(a). 16p. Dep. NTIS $4.00.

A summary of research on a multi-charged heavy ion source of the type proposed by Donetz is given. The fundamental principle consists of "trapping" a certain volume of neutral atoms or weakly charged ions in a confining electric and magnetic field configuration, and to bombard them with a dense electron beam having a uniform velocity and being adjustable so as to attain higher ionization states by means of successive collisions. An electron gun sends a beam of uniform diameter into the interior of a solenoid which gives rise to a radial potential well with respect to the ions by means of a space charge effect. The electron beam propagates longitudinally through a series of tubes to which a potential distribution is applied having a hump at each extremity. Neutral atoms are introduced in the middle of the source and, as soon as they become singly ionized, become prisoners in this "bathtub." At the end of an appropriate time interval, the potential of the final tube is reduced to zero, thus permitting the exit and extraction of ions, while the electron beam is bent by a magnetic field at the exit and is removed by a collector. (WHK)

33490 STUDY OF THE VARIATION OF THE COMPOSITION OF AN ION BEAM. Kucuk, M. (Faculte des Sciences, Istanbul). Istanbul Univ. Fen Fak. Mecm., Seri C; 36: No. 1-4, 69-77(1971). (In French).

By the addition of two cylindrical electrostatic lens to a rf source and by deflecting the ion beam by 21° with a magnetic deflector, the variation of the composition of the beam with respect to various parameters and the relative abundances of different ion were determined. (tr-auth)

33491 SIMPLE MODEL FOR THE ACCELERATION OF IONS BY HIGH-CURRENT RELATIVISTIC ELECTRON BEAMS. Aleksander, K.; Khantche, E.; Zimrot, P. (Central Inst. of Electron Physics, Berlin). Zh. Eksp. Teor. Fiz.; 67: No. 2, 567-578(Aug 1974). (In Russian).

A new model of ion acceleration by relativistic electron beams is proposed which considers explicitly the influence of the accelerated ions on the beam-front dynamics. The basic ideas are: Ions are produced within the beam front by electron and ion impact ionization, creating a partial space charge neutralization which cancels the electrostatic stopping of the beam. Space charge fields in the accelerating beam front accelerate the produced ions, part of which achieve a higher velocity than the front and leave the beam across its leading edge. These ions form a fast beam of high energy and low energy spread and produce further ions in front of the electron beam edge. The electron beam-front dynamics is closely coupled with ion-bunch relaxation and acceleration. The model is one-dimensional, it neglects magnetic effects and is simplified as much as possible. In spite of this it explains qualitatively and partly quantitatively most experimental facts, such as pressure dependence of electron-beam velocity and ion current, and charge dependence of ion energy and ion current. (auth)

33492 CALCIUM DOUBLE K-SHELL IONIZATION PRODUCED FROM 24.0- TO 48.0-MeV OXYGEN BOMBARDMENT. Olsen, D. K.; Moore, C. F. (Univ. of Texas, Austin). Contract AT(40-1)-2972. Phys. Rev. Lett.; 33: No. 4, 194-197(22 Jul 1974).

Relative x-ray-production cross sections for Ca Kα satellite and hypersatellite transitions produced from 24.0- to 48.0-MeV oxygen bombardment of thick targets. All cross-section ratios as functions of projectile energy for initial defect configurations K^kL^l, where k = 1,2 and l = 0,1,2,3,4, are in qualitative agreement with configuration-space binary-encounter-approximation predictions. (auth)

33493 SURFACE AND VACUUM PHYSICS INDEX. Volume 9, No. 7, 1974. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 84p.

33494 EXCITATION OF METAL ATOMS BY THE METHOD OF INTERSECTING BEAMS IN FAR VACUUM ULTRAVIOLET. Vukstich, V. S.; Samsonov, V. V.; Demeter, A. M. (Uzhgorod State Univ., USSR). Ukr. Fiz. Zh. (Russ. Ed.); 19: No. 6, 1040-1041(Jun 1974). (In Russian).

The experimental installation designed for the study of the optical transitions in the region of 20 to 150 nm, excited by the collision of electrons with metal atoms, was described. The method used was the intersecting beam method. The experimental installation was fabricated on the basis of a vacuum monochromator with glancing angle of incidence and systems for the registration of vacuum uv radiation. The dependences of the efficiency of the excitation of the $2p^6\ {}^1S_0[1/2;\ 1\frac{1}{2}]_1^1$ for NaII and $3p^6\ {}^1S_0[1/2;\ 1\frac{1}{2}]_1^1$ for KII were obtained experimentally in the energy interval from threshold to 200 eV. (tr-auth)

33495 VALIDITY OF THE RECIPROCITY PRINCIPLE IN THE ELASTIC SCATTERING OF ELECTRONS (400 TO 1500 eV) BY THE (001) FACE OF MgO. Mosser, A.; Burggraf, C.; Goldsztaub, S. (Univ., Strasbourg). Compt. Rend., Ser. A; 278: No. 9, 327-330(25 Feb 1974). (In French).

The validity of the reciprocity principle was experimentally verified for electrons (400 to 1500 eV) incident on the (001) face of MgO; the agreement remains satisfactory for electrons having lost up to 200 eV of energy. (auth)

33496 OPTICAL RADIATION OF ATOMS SPUTTERED FROM METALLIC TARGETS BY ION BOMBARDMENT. Gabla, L.; Szymonski, M.; Szulkin, M. (Jagellonian Univ., Krakow). Acta Phys. Pol.; A46: No. 3, 385-387(Sep 1974).

New experimental data related to optical radiation from copper and zinc targets, both mono- and poly-crystalline, bombarded with He^+ ions of 8 keV energy are described. The properties of light emitted by sputtered atoms are briefly discussed. (auth)

33497 SPACE CHARGE DISTRIBUTION NEAR TO AN α PARTICLE BEAM. Brock, J. (Univ. of Texas, Austin); Bricard, J.; Madelaine, G.; Pourprix, M. Compt. Rend., Ser. B; 278: No. 10, 425-428(4 Mar 1974). (In French).

The experiments conducted are described. A simplified theory is proposed which establishes, the part played by electrons in determining the ion distribution near to the α particle trajectories. (auth)

Atomic and Molecular Properties

Refer also to abstract 31598.

33498 (EUR-CEA-FC-720) IONIZATION POTENTIALS OF IONS FROM GALLIUM TO MOLYBDENUM. Schwob, J. L. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Jan 1974. 15p. (In French). Dep. NTIS (US Sales Only) $4.00.

A complete set of ionization potentials of all ionization stages is given for elements gallium through molybdenum (Z = 42). These calculations complete the results published by LOTZ for lighter elements (from H to Zn), and use the same method. This method proceeds by extrapolation of the second or third differences for successive elements along an isoelectronic sequence, starting from experimentally well known values for the first low ionized members. Experimentally not so well established sequences are calculated by extrapolation of potential differences to ions in the same ionization stages of a better known sequence. (FR)

33499 (GSI-T-1-74) DIRAC-FOCK-SLATER CALCULATIONS OF THE ELEMENTS FERMIUM (Z = 100) TO Z = 173. Soff, G.; Fricke, B. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Mar 1974. 34p. INIS.

6 figs.; 4 tabs.; 20 refs. With abstract.

Energy eigenvalues and total energies are listed for the elements fermium to element 173 using relativistic Dirac-Fock-Slater calculations. The effect of high ionization on the energy eigenvalues is presented for two examples. The use of these tables within the atomic physics of superheavy elements, using MO transitions as a tool, is discussed. In addition a brief comparison between the results of the Dirac-Fock-Slater and Dirac-Fock calculations is presented. (auth)

33500 (SAND-74-8509) ENERGY LEVELS AND ELECTROMAGNETIC PROPERTIES OF HYDROGEN-LIKE ATOMS. Faustov, R. N. Translated by P. Newman from Fiz. Elem. Chastits At. Yadra; 3: No. 1, 238-268(1972). 51p. Dep. NTIS $5.75.

A review is given of the present status of the theory of the simplest two-particle systems: hydrogen-like atoms. As the foundation of such a theory, the three-dimensional quasipotential method of Logunov and Tavkhelidze is used in a proposed new relativistically invariant formulation. Most attention is paid to the energy level corrections due to nuclear structure and motion effects, the positronium energy levels and the relativistic corrections to the atomic magnetic moment. The theory is compared with the most recent experimental data. (auth)

33501 CALCULATION OF THE DIPOLE MOMENTS OF THE HD, HT, AND DT MOLECULES BY THE DOUBLE PERTURBATION THEORY. Gur'yanov, A. V.; Rebane, T. K. (Leningrad State Univ.). Teor. Eksp. Khim.; 10: No. 3, 371-374(1974). (In Russian).

A simple model for the replacement of the mass asymmetry of nuclear core in nonsymmetrical isotopic modifications of two-atom molecules with similar charges of the nucleus of the effective charge asymmetry of the nuclear core. This model makes it

possible to calculate the electric dipole moments of this class of molecules in the framework of the usual adiabatic approximation and leads to results in good agreement with the calculations of other authors. (tr-auth)

33502 FRANCK–CONDON FACTORS AND R-CENTROIDS FOR THE B-X TRANSITION OF $La^{16}O$ AND $La^{18}O$, INCLUDING ROTATION–VIBRATION INTERACTION. Maranon, J. (Univ. Nacional, La Plata); Suarez, C. B. Spectrosc. Lett.; 7: No. 7, 303-309(1974).

Franck–Condon factors and r-centroids for the green–yellow system of $La^{16}O$ and $La^{18}O$ are reported. Calculation includes rotation–vibration interaction, and a significant variation when the rotational quantum number changes has been found. (auth)

33503 GROUP RING OF THE DYNAMICAL INVARIANCE GROUP OF THE HYDROGEN ATOM. I. Dirl, R. (Technische Univ., Vienna). Nuovo Cim.; 23B: No. 2, 417-440(11 Oct 1974).

$SU_2 \otimes SU_2$, being the universal covering group of SO_4, is equally well suited to be the dynamical invariance group of the hydrogen atom. A representation $\bar{L}[SU_2 \otimes SU_2]$ of the corresponding group ring is used to classify completely the eigenfunctions and to represent every operator commuting with the Hamiltonian as a unique linear combination of some special ring elements. An obvious extension of these ring elements in question yields a special basis of the linear operator space L(H') containing the ring of bounded operators L(H) and $\bar{L}[SU_2 \otimes SU_2]$ as subspaces. This operator basis will serve for the definition of a further basis of L(H') whose elements are irreducible tensor operators with respect to $SU_2 \otimes SU_2$. (auth)

33504 GROUP RING OF THE DYNAMICAL INVARIANCE GROUP OF THE HYDROGEN ATOM. II. Dirl, R. (Technische Univ., Vienna). Nuovo Cim.; 23B: No. 2, 441-472(11 Oct 1974).

A method of construction of irreducible tensor operators with respect to $SU_2 \otimes SU_2$ is discussed. This method permits the unique decomposition of an arbitrary operator into corresponding irreducible tensor operators. It also allows one to derive selection rules if the operator is an irreducible tensor operator with respect to the subgroup $SU_2 \times SU_2 \simeq SU_2$. A basis of the operator space L(H') consisting of irreducible tensor operators with respect to $SU_2 \otimes SU_2$ permits a unique alternative decomposition of every operator. This tensor basis (Wigner operators) has the essential property that its elements are uniquely labelled only by parameters needed for the determination of the unitary irreducible representations of $SU_2 \otimes SU_2$. This basis not only suggests certain approximations but also is useful for the definition of new operators (creation and destruction operators). (auth)

33505 HARTREE–FOCK–ROOTHAAN WAVE FUNCTIONS FOR DIATOMIC MOLECULES. II. First-Row Homonuclear Systems A_2, A_2^+, and A_2^-. Cade, P. E.; Wahl, A. C. (Univ. of Chicago). At. Data Nucl. Data Tables; 13: No. 4, 339-389(Apr 1974).

Tables of electronic wave functions are presented for 43 homonuclear diatomic systems, A_2, A_2^+, and A_2^-, involving first-row elements Li through F. These wave functions were obtained at the experimental (or theoretical) internuclear separation and are expansion solutions of the restricted Hartree–Fock equations. The various molecular orbitals are expanded in extensive sets of symmetry-adapted Slater-type functions. The repertory of states includes the experimental ground states of the systems indicated, a few low-lying excited states, and certain positive and negative ions. The calculations are restricted to electronic states involving either closed-shell electron configurations or open-shell configurations with one incompletely filled open shell. The quality, limitations, and gross details of these calculations are briefly discussed. (auth)

33506 DISCHARGE PHENOMENA AND AFTERGLOW EXPERIMENTS RELATED TO THE JESSE EFFECT. Schmeltekopf, A. L.; Fehsenfeld, F. C.; Lindinger, W. (Environmental Research Labs., Boulder, CO). Radiat. Res.; 59: No. 2, 356 (Aug 1974).

The use of helium metastables in the NOAA flowing afterglow experiment was discussed. Measurements of deexcitation rate constants made in this system were described and the long-standing experimental disagreement between the afterglow measurements made in a temperature-variable system were presented. Data were obtained for $He(2^3S)$ on several gases in the temperature range 300 to 900°K. (JFP)

33507 POTENTIAL ENERGY CURVES AND RADIATIVE TRANSITION PROBABILITIES FOR RARE-GAS MOLECULES. Mulliken, R. S. (Univ. of Chicago). Radiat. Res.; 59: No. 2, 357-362(Aug 1974).

The discussion of potential energy curves and radiative transition probabilities for rare-gas molecules includes possible needed changes in the curves and conclusions of previous work. Also some consideration is given to radiative transition probabilities from the two lowest excited states of Ne_2, Kr_2, and Xe_2. (JFP)

33508 ENERGY PATHWAYS, INCLUDING THE JESSE EFFECT, IN NOBEL GASES. Hurst, G. S. (Oak Ridge National Lab., TN). Radiat. Res.; 59: No. 2, 350-355(Aug 1974).

The review of energy pathways in noble gases including helium and argon covers the W value and the Jesse effect, emission of vacuum ultraviolet radiation, absolute measurement of vacuum ultraviolet energy, time dependence of the vacuum ultraviolet emission, quenching of vacuum ultraviolet radiation, and the transport of resonance radiation. (JFP)

33509 ROTATION–VIBRATION LEVEL ENERGIES OF THE HYDROGEN AND DEUTERIUM MOLECULE-IONS. Hunter, G.; Yau, A. W.; Pritchard, H. O. (York Univ., Downsview, Ont.). At. Data Nucl. Data Tables; 14: No. 1, 11-20(Jul 1974).

Bound and quasi-bound rotation–vibration level energies, calculated in the adiabatic approximation, are tabulated for H_2^+ and D_2^+, together with the resonance widths of the less stable quasi-bound states. Bound levels for HD^+, calculated from a single adiabatic internuclear potential, are also listed, together with an estimate of their likely range of validity. Expectation values for the internuclear separations are also presented, graphically. (3 figures, 4 tables) (auth)

33510 CHANGE IN THE BEHAVIOR OF PHOTOIONIZATION CROSS SECTIONS INSIDE ISO-ELECTRONIC SEQUENCES. Lamoureux, M.; Combet Farnoux, F. (Univ., Paris). J. Phys. (Paris); 35: No. 3, 205-214(Mar 1974). (In French).

Calculations of photoionization cross sections were carried out: on the one hand, sigma 2p for some ions in the isoelectronic series of $Ne(2p^6)$, $Ne^+(2p^5)$, $Ne^{2+}(2p^4)$; on the other hand, sigma 3p for some ions in the isoelectronic series of $Ar(3p^6)$ and Ar^+ $(3p^5)$. This study deals with atomic numbers between 10 and 13 (Ne, Na, Mg, Al) and between 18 and 21 (Ar, K, Ca, Sc). All these ions are supposed to be in their ground state. A single-electron and nonrelativistic model, with a central and non-Coulomb potential, was used; this is the central potential equivalent to the nonlocal Hartree–Fock potential appropriate for an electron in the subshell which is active in the photoionization process, the ion being in its initial state. The work points out the evolution of the behavior of photoionization cross sections with the ionization degree, both within an isoelectronic series and for the same atomic number. Its essential feature is the motion of the various maxima of the cross section towards the ionization threshold after the first ionizations, the hydrogenic behavior being reached only after several extra ionizations necessary for the second maximum to be fixed at the threshold. (FR)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstract 34011.

33511 MUONIC X RAYS FROM SEPARATED ISOTOPES OF YTTERBIUM. Adler, D. T. Pittsburgh; Carnegie-Mellon Univ. (1974). 102p. University Microfilms Order No. 74-20,362.

Thesis (Ph. D.).

Observations of muonic x-ray spectra from the enriched isotopes ^{171}Yb, ^{172}Yb, ^{173}Yb, ^{174}Yb, and ^{176}Yb were made with a stabilized, high precision Ge(Li) spectrometer for the purpose of studying the nuclear charge distribution of these deformed nuclei. The analysis assumes a specific model for the distribution of nuclear charge (a modified Fermi distribution) and the Bohr–Mottelson model for collective nuclear rotational levels. For each nucleus the skin thickness, t, the half-density radius, c, and the intrinsic quadrupole moment, Q_0, are found. The rms radii of the charge distributions are calculated. Corrections for vacuum polarization, nuclear polarization, the Lamb shift, and nuclear motion are included in the analysis. Errors in the parameters of the nuclear model are due as much to uncertainties in these corrections as they are to experimental errors. An unusual intensity anomaly is observed in both the L and K spectra of ^{172}Yb, and the calculated energy of the highest energy K line disagrees with the measured energy by 12 keV. In ^{173}Yb the necessity of including the rotational $11/2^-$ nuclear level yields a crude measurement of the energy of that level, $E = 303 \pm 8$ keV. (Diss. Abstr. Int., B)

33512 ORTHOPOSITRONIUM ANNIHILATION IN LIQUID AND SOLID HELIUM. Smith, J. B. Jr. Cleveland; Case Western Reserve Univ. (1974). 126p. University Microfilms Order No. 74-16,526.

Thesis (Ph. D.).

Lifetime measurements of orthopositronium in liquid and solid helium as a function of pressure and at temperatures of 1.4, 1.7, and 4.2°K are reported. These measurements were performed in order to investigate the structure of the bubble from which the orthopositronium annihilates, the energy barrier for positronium penetration into helium, and the pickoff rate of orthopositronium in helium. The existing theoretical results do not adequately explain the data. (Diss. Abstr. Int., B)

33513 ENERGY LEVELS OF PI-MUONIUM. Cho, C. F. (Stanford Univ., CA). Nuovo Cim., 23A: No. 3, 557-580(1 Oct 1974).

An experiment was recently proposed and planned to measure the energy levels of the π-μ atom (pi-muonium). Expressions are obtained for all QED contributions to the $2S_{\frac{1}{2}}$, $2P_{\frac{1}{2}}$ and $2P_{\frac{3}{2}}$ level shifts of pi-muonium accurate to 10^{-4} eV. Detailed discussions are given for the recoil corrections to the spinor–scalar system by means of an effective-potential method. The contributions of the total hadronic vacuum polarization and the weak interaction are also discussed. If the 2S–2P energy level difference in pi-muonium can be measured accurately to 10^{-4} eV, an independent determination of the pion charge radius can be obtained. The π–e and the π–π atoms which are also produced in K decay are also discussed briefly. (auth)

33514 NEW METHOD TO INDUCE TRANSITIONS IN MUONIC ATOMS USING A HIGH POWER TUNABLE DYE LASER COUPLED TO A STOPPING MUON BEAM. Bertin, A. (CERN, Geneva); Carboni, G.; Placci, A.; Zavattini, E.; Gastaldi, U. Nuovo Cim.; 23B: No. 2, 489-526(11 Oct 1974).

An apparatus is described in which a ruby-pumped dye laser is used to induce transitions from the 2S to the 2P levels of the muonic ion $(\mu He)^+$. The dye laser supplies infrared radiation pulses in the wavelengths (8040 to 8180) Å, at typical repetition rates of 1 pulse every 4 s, with an energy release per pulse of 300 mJ for 1.2 J pumping. (auth)

33515 INHIBITION OF POSITRONIUM FORMATION IN CERTAIN SOLUTIONS. Gol'danskii, V. I.; Koldaeva, O. V.; Shantarovich, V. P. (Inst. of Chemical Physics, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 103-106(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 124-128(1974).

Consideration of the possibility of using Ore's model to describe the formation of positronium in solutions leads to an examination of several inhibition variants, one of which is an enhanced deceleration of positrons (compared with the pure solvent) to an energy region below the threshold for positronium formation, resulting from, for example, excitation of the first electronic level of the additive. The mixture of acetone and acetic acid used in this work, with known values of the Ore gaps, appears to be the first authentic example of the inhibition variant. A quantitative description of the effect is given, and the cross sections for positronium formation and for excitation by positrons of the first excited electronic level of acetone are evaluated. A number of examples supporting the inhibition variant were also observed, consisting of the "attachment" of positrons to one of the dissociation products. (auth)

33516 CHEMISTRY OF NEGATIVE ELEMENTARY PARTICLES AND A DYNAMIC MODEL OF MESON MOLECULES. Kholodov, N. I.; Gol'danskii, V. I. (Inst. of Chemical Physics, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 143-144(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 175-176(1974).

Results of a number of experiments and characteristics of the dynamics of de-excitation processes are discussed, using as a basis a detailed analysis and modification of existing models of meson molecules. (JFP)

33517 ATOMIC PHENOMENA DEPENDING ON WEAK INTERACTION AND NEUTRAL CURRENTS. Zeldovich, Y. (Inst. of Applied Mathematics, Moscow). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 155-156(1974).

Parity violation means that the state of a given particle or system can be a superposition of states with different parities. The decay of such particles and interference of $S_{\frac{1}{2}}$ and P components are addressed. 1- and 2-photon decay is considered. Muonic hydrogenlike atoms are the best objects for study. (1 table) (RWR)

33518 PARITY VIOLATIONS BY NEUTRAL CURRENTS IN MUONIC ATOMS. Bernabeu, J.; Ericson, T. E. O.; Jarlskog, C. (CERN, Geneva). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 165-176(1974).

The 2S–1S transition in low-Z muonic atoms is shown to be extremely sensitive to possible parity violation, such as may be introduced by neutral currents. The most striking effects of parity violation are found in the case of muonic Li and Be, where they are estimated to be of the order of 10% on the basis of current models. (1 figure, 1 table) (auth)

33519 ELECTROPRODUCTION OF MUONIC ATOMS. Dmitriev, V. F. (Inst. of Nuclear Physics, Novosibirsk, USSR). Yadern. Fiz.; 20: No. 2, 402-406(Aug 1974). (In Russian).

An expression is obtained for the total cross section of the electroproduction of muonic atoms on nuclei, as well as for the spectrum of positive muons. Various applications of this process for experiments in region of the low energy nuclear physics are considered. (auth)

Collision Phenomena

Refer also to abstracts 33550, 33639, 33918, and 33964.

33520 (AD-774943) MOLECULAR BEAM STUDIES OF ATOMIC COLLISIONS. Final Report, 1 September 1969–31 December 1973. Neynaber, R. H. (Intelcom Rad Tech, San Diego, Calif. (USA)). 28 Feb 1974. Contract N00014-70-C-0037. 15p. (RT-8007-004). NTIS $3.00.

A summary of the research performed over the period 1 September 1969–31 December 1973 is presented. Most of the work consisted of studies of ion-molecule reactions by merging-beams techniques. Species involved included Ba, O, N2, O2(+), NO(+), N2(+), N(+), and O(+). In addition, a study was made of associative ionization in collisions of He(*) with H2. (Modified author abstract) (GRA)

33521 (AD-777287) EXCITATION BY ELECTRONIC AND ATOMIC COLLISIONS OF RARE GASES OCCURRING IN THE ATMOSPHERE. Final Report, 16 January 1969–31 December 1973. Lin, C. C. (Wisconsin Univ., Madison (USA). Dept. of Physics). 14 Feb 1974. 10p. NTIS $3.00.

A theoretical scheme for characterizing the excitation functions and cross sections of neon was developed. The results are in good agreement with experiment. Electron excitation functions of some 30 states of argon were measured, and the results can be explained by extending the theoretical scheme described above. The ionization-excitation cross sections of He to the 4S, P, D, F, states of He(+) were measured. Electron excitation functions of some 15 states of potassium were measured. Electron excitation cross sections of individual magnetic sublevels of 4 doublet $P(^3/_2)$ of K were measured. (Modified Author Abstract)

33522 (AD-777701) SUPER-RADIATION OF CONDENSED XENON DURING EXCITATION WITH FAST ELECTRONS. Basov, N. G.; Bogdankevich, O. V.; Danilychev, V. A.; Kashnikov, G. N.; Kerimov, O. M. Translated by P. J. Reiff from Vysokomol. Soedin., Ser. B; No. 7, 68-74(1970). 12p. (FTD-HT-23-272-24). NTIS $3.00.

The discussion covers superradiance, excitation, photoionization, coherent radiation, electron irradiation, and liquefied gases. (JFP)

33523 (AD-778424) MONTE CARLO CALCULATIONS OF REACTION RATES AND ENERGY DISTRIBUTIONS AMONG REACTION PRODUCTS: REACTIONS OF HF AND DF WITH H AND D ATOMS. Report for January–May 1973. Wilkins, R. L. (Aerospace Corp., El Segundo, Calif. (USA)). 15 Jan 1974. Contract F04701-73-C-0074. 67p. (SAMSO-TR-74-94). NTIS $3.75.

Rate coefficients are calculated for the reactions of H- and D-atoms with vibrationally excited HF and DF molecules. Three-dimensional classical trajectories of the collision dynamics of these reactions were calculated by means of the London–Eyring–Polanyi–Sato (LEPS) potential energy surface. The Monte Carlo procedure is used to start each collision trajectory. It is indicated that (1) chemical exchange provides an efficient mechanism for relaxing vibrationally excited HF and DF molecules by H- and D-atoms, (2) multiple-quantum transitions are important in the deactivation processes, and (3) both vibration-translation and vibration-rotation energy transfer contribute to vibrational relaxation of vibrationally excited HF and DF molecules by H- and D-atoms. Rate coefficients are provided for many reactions that have not been measured experimentally. (auth)

33524 (COO-2186-17, pp 5-8) VELOCITY DEPENDENCE OF PROTON AND α-PARTICLE EXCITED Kα SATELLITE INTENSITY. Dutkiewicz, V.; Cue, N.; Sen, P.; Bakhru, H. Jun 1974.

In annual report of the Nuclear Accelerator Laboratory, June 1, 1973–May 31, 1974.

33525 (COO-2186-17, pp 57-62) $Z^{\frac{1}{2}}$ DEPENDENCE OF K-SHELL IONIZATION CROSS SECTIONS AT 7.1 MeV/amu. Cue, N.; Dutkiewicz, V.; Sen, P.; Bakhru, H. Jun 1974.

In annual report of the Nuclear Accelerator Laboratory, June 1, 1973–May 31, 1974.

33526 (GSI-73-11) WORKING MEETING ON "SPECIAL PROBLEMS IN HEAVY-ION SCATTERING–ATOMIC PHYSICS PRINCIPLES AND ATOMIC PHYSICS EXPERIMENTS IN HEAVY-ION ACCELERATORS". Fricke, B.; Armbruster, P. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R.

Germany)). Sep 1973. 171p. (In German, English). (AEC-CONF-73-688-000; CONF-730672-). INIS.

From conference on special problems of heavy ion research; Darmstadt, F. R. Germany (19 Jun 1973).

With figs., tabs., and refs.

This workshop was devoted to atomic physics with heavy-ion accelerators. Its purpose was a discussion of new results and methods in this field of research resulting eventually in proposals for experiments at the UNILAC accelerator. The talks presented included the following topics: Auger electron spectroscopy, inner shell ionization, radiative capture and bremsstrahlung production by heavy ions, and structure calculations for heavy and super-heavy atoms. (GE)

33527 (ORNL-TM-4697) TIME RESOLVED QUENCHING OF ARGON RESONANCE RADIATION BY NITROGEN MOLECULES. McNeely, J. R.; Hurst, G. S.; Wagner, E. B.; Payne, M. G.; Jacobson, H. C. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. Contract W-7405-eng-26. 89p. Dep. NTIS $7.50.

Thesis.

Rate constants for the discrete-discrete transfer of electronic energy from argon resonance states, $Ar(^1P_1)$ and $Ar(^3P_1)$, to the nitrogen molecule, N_2, were measured using the time-resolved quenching technique. Time-dependent emission intensities of the argon resonance lines, initially excited by 1.8-MeV protons, were measured for systems with argon pressures between 30 and 200 torr, at 300°K, and with small quantities of N_2 mixed with the argon. The early time dependence was exponential and the decay constant increased linearly with N_2 partial pressure. For the reaction $Ar^*(^1P_1) + N_2 \xrightarrow{k_Q} Ar(^1S_0) + N_2^*$, $k_Q = 5.4 \times 10^{-11} \pm 0.2$ molecule^{-1} cm^3 sec^{-1}, and for the reaction $Ar^*(^3P_1) + N_2 \xrightarrow{k_Q} Ar(^1S_0) + N_2^*$, $k_Q = 0.8 \times 10^{-11} \pm 0.1$ molecule^{-1} cm^3 sec^{-1}. (auth)

33528 DETERMINATION OF THE CHARGE EXCHANGE AND IONIZATION CROSS SECTION FOR THE IONS H_1^+, H_2^+, H_3^+, . AND D_1^+ WITH AN ENERGY BETWEEN 10 AND 45 keV BOMBARDING A WATER VAPOR TARGET. Kucuk, M. (Faculte des Sciences, Istanbul). Istanbul Univ. Fen Fak. Mecm., Seri C1; 36: No. 1-4, 29-59(1971). (In French).

Among the different types of interactions produced when a beam of ions met a target of water vapor, it appeared of interest to determine the charge exchange (σ_{10}) and ionization (σ_{01}) cross sections for the ions H_1^+, H_2^+, H_3^+, and D_1^+ and their variation as a function of the energy of the beam. The accelerator of the Faculte des Sciences de Toulouse, a duoplasmatron, was used with the modifications necessary to obtain the optimum operating conditions (pressure, intensity of the confinement magnetic field, diaphragm, etc.). Secondary emission detectors (multipliers) and calorimetric detectors were used. For the H_1^+ ions at 30 keV the cross sections $\sigma_{10} = 2.75 \times 10^{-16}$ cm^2 and $\sigma_{01} = 2.35 \times 10^{-16}$ cm^2 were found. The mass spectra of the H, D, He, Ne, N, and Ar ion were traced. (tr-auth)

33529 FORMATION OF D_1^+ IONS BY CHARGE TRANSFER FROM Ar^+ AND H_2^+ TO D_2 IN THE ENERGY RANGE UP TO 100 eV, AND THEIR ION–MOLECULE REACTIONS TO FORM D_3^+. Malkhasyan, R. T.; Zhurkin, E. S.; Tikhomirov, M. V.; Tunitskii, N. N. (Physical Chemistry Inst., Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 160-162(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 189-191(1974).

As charge transfer agents, primary ions with energies up to 100 eV were used. The obtained data on charge transfer cross sections in this region are of inherent interest since charge transfer at high energies was not studied in sufficient detail. (JFP)

33530 EXCITATION OF THE He^+ RESONANCE LEVEL IN ELECTRON–ATOM, ELECTRON–ION, AND ION–ATOM COLLISIONS. Dashchenko, A. I.; Zapesochnii, I. P.; Imre, A. I.; Vukstich, V. S.; Danch, F. F.; Kel'man, V. A. (Uzhgorod State Univ., USSR). Zh. Eksp. Teor. Fiz.; 67: No. 2, 503-509(Aug 1974). (In Russian).

Excitation of the resonant level of the He^+ ion in three collision processes, $e - He^+(1s)$, $e - He(1s^2)$ and $He^+(1s) - He(1s^2)$, is investigated with a mass-spectroscopy arrangement with crossed modulated electron and ion beams by the spectroscopic technique. The energy dependence of the effective cross sections for $He^+(2p)$ excitation in electron-ion collisions is compared with the theoretical calculations in various approximations and with the results on excitation in electron-atom and ion-atom collisions. (auth)

33531 FORMATION OF H(2P) ATOMS IN COLLISIONS OF PROTONS WITH HYDROGEN ATOMS. Girnius, R. Pittsburgh; Univ. of Pittsburgh (1973). 105p. University Microfilms Order No. 74-18,432.

Thesis (Ph. D.).

Cross sections for emission of Lyman-α radiation owing to the formation of H(2P) atoms in collisions of 0.75–29 keV protons with hydrogen atoms were determined by modulated crossed beam techniques. The reactions observed were: $H^+ + H(1S) \rightarrow H^+ + H(2P)$ (direct excitation) and $H^+ + H(1S) \rightarrow H(2P) + H^+$ (electron capture). The ratio of the Lyman-α intensity emitted by proton and electron impact, measured with an oxygen-filtered photomultiplier tube at 54.7° with respect to the plane formed by the proton (or electron) and atomic hydrogen beams, enabled the relative direct and capture excitation cross sections to be normalized to the Born cross section for electron hydrogen atom collisions at 1000 eV. The narrow bandwidth of the oxygen filter allowed separation of the Doppler shifted Lyman-α radiation, emitted by H(2P) atoms formed in electron capture by the incident protons, from the unshifted Lyman-α emitted by the far slower directly excited H(2P) atoms. A liquid helium cryopump was used to reduce the background noise. The cross sections for the formation of H(2P) atoms are shown to be in reasonable agreement with the measurements of Stebbings et al., and Morgan et al. The cross sections are in good agreement below 25 keV with the coupled-state calculations of Cheshire et al., incorporating a pseudo-state expansion. Above 15 keV the direct excitation data is very well represented by the Glauber calculations of Franco and Thomas. Below 2.2 keV the results are in agreement with a molecular treatment of the collision. Measurements were also carried out using a molecular hydrogen beam. The results are in good agreement with previous experimental determinations of the cross sections in projectile target cell experiments. (Diss. Abstr. Int., B)

33532 IMPROVED POTENTIALS FOR Ne + Ar, Ne + Kr, AND Ne + Xe. Ng, C. Y. (Univ. of Chicago); Lee, Y. T.; Barker, J. A. J. Chem. Phys.; 61: No. 5, 1996-2003(1 Sep 1974).

Improved interatomic potentials for Ne–rare gas pairs were obtained by fitting a multiparameter potential to low energy differential cross sections, second virial coefficients, and diffusion coefficients. All asymmetric Ne–rare gas potentials have narrower attractive wells than those of the symmetric rare gas pairs. The values of r_m and ϵ for Ne + Ar, Ne + Kr, and Ne + Xe are 3.43 Å, 71.9°K; 3.58 Å, 74.5°K; and 3.75 Å, 75.0°K, respectively. (auth)

33533 PRODUCTION OF X-RAYS BY HEAVY ION BOMBARDMENT. Tawara, H. (Kyushu Univ., Fukuoka). Nippon Butsuri Gakkaishi; 29: No. 1, 37-46(Jan 1974). (In Japanese).

Studies concerning the mechanism of inner-shell ionization by heavy-ion bombardment is reviewed in this paper. Cross sections for inner-shell ionization by heavy-ion bombardment are larger than those for proton bombardment by a factor of 10^4 to 10^5 at low energy. At higher bombarding energy, the difference is small. This large difference at low energy can be explained qualitatively by an electron promotion model. When an incident heavy ion approaches sufficiently close to a target atom, the cross of energy levels is caused and an inner-shell electron is promoted to an outer-shell orbit. Fano and Lichten presented the model for symmetric collision, and Barat and Lichten developed the model for the asymmetric collision. The level matching effect is also explained by the electron promotion model. Heavy-ion bombardment causes outer-shell ionization as well as inner-shell ionization. The effect of this phenomenon is clearly seen by increase of the binding energy of inner-shell electrons and increase of luminescence yield. In a solid target, continuous ionization is caused because of the short period between succeeding collisions. Observation of x-rays with wide spectrum, different from characteristic x-rays, is reported when a solid target is bombarded by heavy ions. This phenomenon is considered to be the transition between molecular orbits. Satellite x-rays were observed in the case of high-energy heavy-ion bombardment. Phenomena associated with highly ionized heavy ions are also described. (JA)

33534 ROTATIONAL AND VIBRATIONAL EXCITATION OF MOLECULES BY SLOW ELECTRON IMPACT. Linder, F. (Trier-Kaiserslautern Univ., Kaiserslauter, Ger.). Endeavour; 33: No. 120, 124-130(Sep 1974).

Recently developed experimental techniques have led to considerable progress in our understanding of the collision processes between electrons and molecules. Vibrational and rotational excitation of the molecules, discussed in detail, are two of the most significant effects that arise. The processes have important applications in reaction kinetics and plasma physics. (auth)

33535 THEORETICAL ELECTRON SCATTERING AMPLITUDES AND SPIN POLARIZATIONS. Electron Energies 100 to 1500 eV. Part III. Li, Na, Mg, P, K, Ca, Sc, Mn, Ga, Br, Sr, Mo, Rh, Cd, Ba, W, and Os Targets. Gregory, D.; Fink, M. (Univ. of Texas, Austin). At. Data Nucl. Data Tables; 14: No. 1, 39-87(Jul 1974).

The Dirac equation was solved numerically in order to obtain elastic low-energy electron scattering factors for selected elements at five energies. From the complex scattering amplitudes, the differential cross sections and spin polarization factors were calculated. The three papers in this series can be used as a basis

for interpolation to obtain the differential cross sections for additional elements and intermediate energies. Since exchange of the incoming electron with the atomic electrons and charge-cloud polarization is not taken into account in the calculations, the scattering factors at angles of less than 10° should be used with caution. (2 figures, 1 table) (auth)

33536 SCATTERING OF METASTABLE RARE-GAS ATOMS. Chen, C. H.; Lee, Y. T. (Univ. of Chicago). Radiat. Res.; 59: No. 2, 444-445(Aug 1974).

The nature of the interaction as well as the reaction of a metastable rare-gas atom, with a ground-state rare-gas atom is investigated using elastic differential cross sections measured by the crossed-molecular-beam method. (JFP)

33537 QUENCHING RATE CONSTANTS FOR THE $Ar(^3P_0)$, $Ar(^3P_2)$, AND $Xe(^3P_2)$ STATES. Setser, D. W.; Piper, L. G.; Velazco, J. E. (Kansas State Univ., Manhattan). Radiat. Res.; 59: No. 2, 441-443(Aug 1974).

The measurement of total quenching cross sections and the identification of product channels from the interaction of the metastable states of the rare-gas atoms with simple molecules are studied. The total quenching cross sections for Ar and Xe and the product channels for reactions of Ar with O, Kr, and Xe are discussed. In some instances qualitative deductions about the relative importance of ionic vs. neutral products in the quenching of Ar and Xe metastable states can be made. (JFP)

33538 BEAM EXPERIMENTS WITH METASTABLE ATOMS. Stebbings, R. F. (Rice Univ., Houston, TX). Radiat. Res.; 59: No. 2, 376-378(Aug 1974).

Two classes of experiments, namely, chemiionization and photoionization are described and the resulting cross sections discussed. Also the crossed-beam apparatus is considered. (JFP)

33539 THEORY OF PENNING IONIZATION. Berry, R. S. (Oxford Univ.). Radiat. Res.; 59: No. 2, 367-375(Aug 1974).

Current state of the theory of Penning ionization is reviewed, in terms of the problems currently under consideration, the physical concepts underlying various recent theories, and some of the approaches that appear tractable or desirable for work in the near future. (auth)

33540 POTENTIAL CURVES, RADIATIVE PROPERTIES, AND RESONANT ENERGY TRANSFER CROSS SECTIONS NEON. Schneider, B. I.; Cohen, J. S. (Los Alamos Scientific Lab., NM). Radiat. Res.; 59: No. 2, 363-366(Aug 1974).

Ab initio calculations of the Ne_2 van der Waals ground state, the excited states of Ne_2 formed in the interaction of Ne with the ground-state atom and given excited states of Ne_2^+ were carried out. (JFP)

33541 MOMENTUM-TRANSFER CROSS SECTIONS FOR ELECTRON COLLISIONS WITH ATOMS AND MOLECULES. Itikawa, Y. (Argonne National Lab., IL). At. Data Nucl. Data Tables; 14: No. 1, 1-10(Jul 1974).

A collection and critical review was made of the experimental and theoretical data on momentum-transfer cross sections for electron collisions with H, He, O, Ne, Ar, Kr, Xe, Cs, Hg, H_2, N_2, O_2, CO, NO, H_2O, CO_2, N_2O, NH_3, and CH_4. Best values were estimated and are presented graphically as functions of the electron energy over the range from 0.01 to 10 eV. The literature was searched through December 1972. (auth)

33542 SECONDARY ION-MOLECULE REACTIONS IN MIXTURES OF Ar WITH H_2 AND D_2: CROSS SECTIONS OF FORWARD AND REVERSE REACTIONS OF ArD^+ AND D_3^+. Malkhasyan, R. T.; Tikhomirov, M. V.; Zhurkin, E. S.; Tunitskii, N. N. (Physical Chemistry Inst., Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 158-159(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 187-189(1974).

The dependence of the absolute cross sections of the forward and reverse ion-molecule reactions on the kinetic energy of the colliding particles at up to 100 eV was investigated directly. The ions and molecules ArD^+, D_2, D_3^+, Ar, D_2H^+, and H_2 were considered. (JFP)

33543 ELECTRON-MATTER INTERACTIONS: CALCULATION OF CROSS SECTIONS. Arnal, F.; Balladore, J. L.; Marais, B.; Verdier, P. (CNRS, Toulouse). Compt. Rend., Ser. B; 278: No. 10, 397-399(4 Mar 1974). (In French).

A slight modification to the Wentzel potential near to the atom enables a correct explanation to be given for the cross section values obtained experimentally with incident electrons having energies in the 300 to 1200 keV range. (auth)

33544 ANALYSES OF IONS AND ELECTRONS RESULTING FROM PENNING IONIZATION. Hotop, H. (Univ., Freiburg, Ger.). Radiat. Res.; 59: No. 2, 379-404(Aug 1974).

A survey of experiments recently done in the field of Penning ionization by electronically excited metastable species is given, and the implication of their results for the basic physical quantities governing the Penning process is discussed. The energy dependence of the total ionization cross section, of its associative fraction, and of the electron energy distribution is compared for the two contrasting groups of repulsive and attractive Penning ionizing systems in the thermal collision energy range. The populations of different electronic, vibrational, and charge states in Penning ions are discussed and compared with populations resulting from photoionization. (auth)

33545 ISOTOPE EFFECTS IN ION-MOLECULE REACTIONS. Ardelean, P.; Mercea, V. (Inst. of Stable Isotopes, Cluj). Stud. Cercet. Fiz.; 25: No. 5, 547-562(1973). (In Rumanian).

The discussion covers isotope effects occurring in reactions at energies less than 10 eV and at energies higher than 10 eV: reaction rate isotope effects, isotope effects in the velocity of the secondary ions, isotope effects in the angular distribution of the secondary ions. (auth)

Atomic Theory

Refer also to abstract 34016.

33546 (UCRL-13604) CHAINJ: AN UNCLASSIFIED VERSION OF AN AVERAGE ATOM OPACITY CODE. Green, J. M.; Karzas, W. J.; Latter, R. (R and D Associates, Santa Monica, Calif. (USA)). Aug 1974. 83p. (RDA-TR-4900-005). Dep. NTIS $7.25.

The code CHAINJ is presented for atom opacity numbers useful for elements of low atomic number ($Z < 11$). The structure of the code, the function of every subroutine, and when possible the details of the calculational methods are presented. Also a complete guide is given to the input formal necessary to run the code. (JFP)

33547 ASYMPTOTICALLY EXACT SOLUTIONS FOR FERMI SYSTEMS. Simenog, I. V. (Inst. of Theoretical Physics, Kiev). Teor. Mat. Fiz.; 20: No. 2, 235-249(Aug 1974). (In Russian).

Fermi systems with large number of particles are investigated in the case of the two-particle interaction potentials leading to contracted systems. Detailed proof is given of the fact that the Hartree and Thomas-Fermi approximations are asymptotically exact for the systems considered. (auth)

33548 FIRST ORDER FUNCTION FOR SEMI-RELATIVISTIC ATOMIC EQUATION. Ivanov, L. N.; Ivanova, E. P. (Inst. of Spectroscopy, Moscow). Teor. Mat. Fiz.; 20: No. 2, 282-287 (Aug 1974). (In Russian).

The first order correction with respect to the interaction between electrons to the solution of the two-electron semi-relativistic atomic equation is represented in the form: $\Psi^{(1)}(r_1,r_2) = (1/2)\,S_k[\psi_k(r_1)\Phi_k(r_2) - \psi_k(r_2)\Phi_k(r_1)]$, $\psi_k(r)$ being solutions of the one-electron Dirac equation. Analytic expressions for $\Phi_k(r)$ are obtained, which are suitable for evaluation of the matrix elements. (auth)

33549 CALCULATION OF ENERGIES OF TWO-ELECTRON SYSTEMS: APPLICATION OF SECOND QUANTIZATION FORMALISM TO OBTAIN ATOMIC, POSITIVE, AND NEGATIVE ION STATES. Fine, J. Washington, DC; Catholic Univ. of America (1974). 139p. University Microfilms Order No. 74-19,414.

Thesis (Ph. D.).

A model calculation of a general method for calculating many-electron atom and ion energies starting from first principles is presented. By transforming the Schroedinger equation into the second quantized, or occupation number, representation, the Hamiltonian becomes independent of the number of electrons in the system. This makes application of the technique straightforward to a system of many electrons and furthermore ensures that the calculation is done in an antisymmetrized framework. Since no approximations are made in the Hamiltonian directly, electron correlation is fully and correctly accounted for. In order to assess the feasibility of this second quantized configuration-interaction approach, a two-electron model calculation was performed for nuclear charge from one through six. The results obtained using a state vector of eleven basis states (total Z-component of spin = 0) demonstrate the versatility of this method. Reasonable ground and excited state energies for both one and two electron excitation were calculated for the singlet and the triplet (Z-component of spin = 0) states. The occupation probabilities for these two-electron states are easily interpretable. The method presented can have wide application to the calculation of many-electron atomic systems. (Diss. Abstr. Int., B)

33550 PSEUDOPOTENTIALS IN ATOMIC AND MOLECULAR PHYSICS. Bardsley, J. N. (Univ. of Pittsburgh). Case Stud. At. Phys.; 4: No. 5, 299-368(Jun 1974).

The pseudopotential concept was introduced into the solution of many-body problems in solid-state physics, quantum chemistry and atomic physics. The formal development of pseudopotential theory is reviewed. The techniques for obtaining pseudopotentials are described and the ab initio and semi-empirical approaches are contrasted. Applications of the method to problems involving atoms and small molecules are discussed, and some new results are presented. These applications include studies of atomic electron affinities, inter-atomic potentials and electron scattering by atoms. (auth)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

Refer also to abstract 33559.

33551 (AD-775581) STRUCTURE OF MAGNETOHYDRODYNAMIC SHOCK WAVES. Technical Summary Report. Smoller, J. A.; Conley, C. C. (Wisconsin Univ., Madison (USA). Mathematics Research Center). Feb 1974. Contract DA-31-124-ARO (D)-462. 19p. (MRC-TSR-1336). NTIS $3.00.

Fast and slow magnetohydrodynamic shock waves of arbitrary strength, for general equations of state and for arbitrary nonzero viscosity matrix, are shown to possess structure. (auth)

33552 (AD-777686) CONTINUOUSLY REZONABLE FLUID SOLVER IN MOVING ORTHOGONAL COORDINATES WITH TIME DEPENDENT METRIC. Anderson, D. V. (Naval Research Lab., Washington, D. C. (USA)). Apr 1974. 32p. (NRL-MR-2769). NTIS $4.75.

A transformation algorithm slide is developed to solve fluid equations in most orthogonal coordinate systems. A very useful and unique feature of the algorithm allows the metric of the orthogonal system to be a function of time. Quasi-Lagrangian grids may then be employed to follow contours of some fluid quantity. One set of grid lines follow the contours and the other sets are constructed orthogonal. As the contours move during the evolution of the problem the metric changes as a function of time. The slide algorithm is then used to solve the fluid equations in this moving coordinate system. Unlike most rezoned algorithms where considerable numerical diffusion is introduced, here the numerical diffusion is actually reduced by the rezoning process. (auth)

33553 (N-18339) CHARGED PARTICLE MOTIONS IN A MAGNETIC FIELD WHICH REDUCE TO MOTIONS IN A POTENTIAL. Stern, D. P. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Mar 1974. 21p. (NASA-TM-X-70604; X-602-74-64). NTIS $4.25.

If the Hamiltonian for the motion of a charged particle in a magnetic field has one or more cyclic coordinates it may often be viewed as representing the motion of a particle subject to a potential V. The use of V provides qualitative insight about the motion even in some cases where a solution of the motion cannot be obtained. Several examples using this concept are reviewed and discussed. (auth)

33554 COMPLETELY CONSERVATIVE DIFFERENCE SCHEMES FOR TWO-DIMENSIONAL MAGNETOHYDRODYNAMICS EQUATIONS. Belan, N. V.; Mashtylev, N. A.; Shushlyapin, L. V. Zh. Vychisl. Mat. i Mat. Fiz.; 14: No. 3, 792-797(1974). (In Russian).

Completely conservative difference schemes are constructed for two-dimensional MHD equations, which are written in Euler variables, for the plane and axially-symmetric cases with an order of approximation $O(\tau + h_1 + h_2)$. It is shown that the completely conservative difference schemes for one-dimensional, MHD equations are a partial case of the completely conservative difference schemes obtained in this study. (SJR)

33555 WAVES AND DISCONTINUITIES IN RELATIVISTIC ANISOTROPIC MAGNETOHYDRODYNAMICS. Cissoko, M. Compt. Rend., Ser. A; 278: No. 9, 641-644(25 Feb 1974). (In French).

The wave and discontinuity distribution technique is used to study a relativistic anisotropic fluid. The conditions for the existence of propagation velocities are studied. (FR)

33556 SPECIAL CONGRUENCES IN MAGNETOHYDRODYNAMICS. Bray, M. Compt. Rend., Ser. A; 278: No. 9, 645-647(25 Feb 1974). (In French).

Current line congruences characterized by $\sigma_{\alpha\beta} = \theta = 0$ are presented. (FR)

33557 NUMERICAL STUDY OF CERTAIN MAGNETOHYDRODYNAMIC FLOWS. Vitolin'sh, G. A.; Kalis, Kh. E.; Peterson, D. E.; Tsinober, A. B. (State Univ., Riga). Chislennye Metody Mekh. Sploshnoi Sredy; 2: No. 5, 13-28(1971). (In Russian).

Formulas were developed for studying the flow of a viscous, incompressible, electrically conducting liquid in a homogeneous infinite magnetic field. It was assumed that the liquid fills a coherent region of a two- or three-dimensional Euclidean field, while an immobile conductor occupies the remainder of the space. The flow problems were solved by means of a set of scalar equations with several boundary conditions. (TTT)

33558 UNIVERSAL STABILITY OF MAGNETO-COSSERAT FLUID MOTIONS. Ahmadi, G.; Shahinpoor, M. (Pahlavi Univ., Shiraz, Iran). Rend. Ist. Lombardo Sci. Lett., A; 107: No. 2, 343-352(1973).

Derivation of criteria for universal stability of the unsteady motion of an incompressible, electrically conducting Cosserat fluid (a fluid with couple stresses) in the presence of an arbitrary magnetic field and in an arbitrary bounded time-dependent domain. The model of the Cosserat continuum employed is essentially based on the couple-stress theory of Truesdell and Toupin (1960), Toupin (1962), and Mindlin and Tiersten (1962). A condition for stability of the original motion is derived, as well as two uniqueness theorems for the unsteady and steady flow of a magneto-Cosserat fluid. The theorems established for stability and uniqueness are universal in the sense that they may be applied to any geometry of bounded domains and any distribution of the basic field variables. (IAA)

33559 SED'MOE SOVESHCHANIE PO MAGNITNOI GIDRODINAMIKE. I. Obshchie i Teoreticheskie Voprosy MGD. (Seventh Conference on Magnetohydrodynamics. I. General and Theoretical Problems in MHD. Conference Held at Riga, USSR, May 16-19, 1972). Birzvalk, Yu. A.; Lielpeter, Ya. Ya.; Shcherbinin, E. V. (eds.). Riga; Izdatel'stvo Zinatne (1972). 307p. (CONF-720587-(P1)).

The papers presented at the Conference are compiled. Nine topics are considered in the general and theoretical section. These are MHD stability and turbulence, MHD boundary layers and jets, MHD flow in channels in a constant magnetic field, flow in channels in a traveling magnetic field, experimental study of flow in channels, generation of magnetic fields by flow, electrohydrodynamics, ferrodynamics (flow of ferromagnetic liquids and suspensions), and heat and mass exchange in electromagnetic fields. (JSR)

33560 COMMENT ON "MAGNETOHYDRODYNAMIC BOUNDARY LAYER CONTROL WITH SUCTION OR INJECTION". Chuang, H. (Univ. of Louisville, KY). J. Appl. Phys.; 45: No. 9, 4129(Sep 1974).

The governing equation for a steady two-dimensional MHD boundary-layer flow is shown to depend upon certain proper assumptions which result in simplification and approximation. Improper assumptions such as a constant free-stream velocity as well as a zero hydrostatic pressure gradient yield an equation which does not actually represent any physical model of an MHD boundary-layer flow on a flat plate. (auth)

33561 GEOMETRY OF CURRENT LINES IN MAGNETOHYDRODYNAMICS. Bray, M. Compt. Rend., Ser. A; 278: No. 8, 575-577(18 Feb 1974). (In French).

The curvature of the current lines and its variation are studied. (FR)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

Electromagnetic

33562 (DESY-74/28) POSSIBLE NUCLEON RESONANCE ADMIXTURE IN THE DEUTERON. Benz, P.; Soeding, P. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Jun 1974. 6p. INIS.

3 figs.; 13 refs. With abstract.

Low-energy, apparently resonant $p\pi^+$ systems are found to emerge when deuterons are struck by high energy photons. These could be $\Delta(1236)$ "spectators" set free from a hypothetical virtual $\Delta\Delta$ state of the deuteron occurring with approximately 3% probability. The possibility of other interpretations of this observation is also explored. (auth)

33563 (KHFTI-73-10, pp 51-53) PHOTOPRODUCTION OF VECTOR MESONS ON THE LIGHTEST NUCLEI. Blagoveshchenskii, V. V.; Lebedev Inst. of Physics, Moscow). 1973. (In Russian).

The photoproduction of vector mesons ρ^0 on the nuclei T, ^{3}He, and ^{4}He was examined theoretically. Expressions were obtained for the photoproduction cross sections (elastic and inelastic) of ρ^0 mesons obtained in the impulse approximation with consideration of the correction to multiple scattering. The relations obtained were correct and for the photoproduction of ω and φ mesons. (INIS)

33564 (NP-20118, pp 57-59) PHOTOPRODUCTION OF NEUTRAL PIONS FROM DEUTERIUM IN THE ENERGY REGION FROM 300 TO 700 MeV. Ando, A.; Hemmi, Y.; Imai, K. (Kyoto Univ.). 19 Mar 1974.

33565 PHOTOPRODUCTION OF CHARGED PIONS ON ^{27}Al AND ^{11}B AT MAXIMUM ENERGIES BETWEEN 2 AND 4.5 GeV. Danagulyan, A. S.; Demekhina, N. A. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 8: No. 5, 321-325(1973). (In Russian).

The yields of the reactions ^{11}B $(\gamma\pi^-)$ ^{11}C and ^{27}Al $(\gamma\pi^+)$ ^{27}Mg are measured by the activation method at maximum bremsstrahlung energies from 2 up to 4.5 GeV. The cross sections for above mentioned reactions equal to 3.5 μb and 2.7 μb respectively are obtained for this energy interval. (auth)

33566 POLARIZATION OF PROTONS FROM THE REACTION $\gamma + p \rightarrow \pi^0 + p$ ON A LINEARLY POLARIZED PHOTON BEAM. Gobenko, V. G.; Derebchinskii, A. I.; Zhebrovskii, Yu. V.; Kolesnikov, L. Ya.; Konovalov, O. G.; Rubashkin, A. L.; Tenishev, A. E. (Physical-Technical Inst., Kharkov). JETP Lett. (USSR) (Engl. Transl.); 19: No. 10, 340-341(20 May 1974).

Translated from Zh. Eksp. Theor. Fiz., Pis'ma Red.; 19: No. 10, 659-662(20 May 1974).

Experimental results of the measurement of the polarization of protons from the reaction $\gamma + p \rightarrow \pi^0 + p$ on linearly polarized 495-MeV photons with the polarization vector directed perpendicular and parallel to the plane of the reaction are presented for the first time. (JFP)

33567 PHYSICS WITH THE BONN ELECTRON SYNCHROTRONS. Althoff, K. H. (Univ., Bonn). pp 735-771 of Properties of the Fundamental Interactions. Vol. 9. Pt. C. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From Properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PC).

The topics covered are beams available at the two accelerators, photon and electron as primary particles, real and virtual photons, photoproduction of pseudoscalar mesons, helicity and multipole amplitudes, experiments at 500-MeV, differential cross section for the reactions $\gamma + p \rightarrow \pi^0 + p$ and $\gamma + p \rightarrow \pi^+ + n$, measurement of the recoil nucleon polarization, analysis of the π^+- and π^0-data below a photon energy of $E_\gamma = -500$ MeV, other experiments at the 500-MeV machine, the experimental program at the 2.5-GeV synchrotron, and photoproduction of pseudoscalar mesons at intermediate energies. (JFP)

33568 PHOTON-PHOTON COLLISIONS IN ELECTRON-POSITRON STORAGE RINGS. Kessler, P. (College de France, Paris). pp 821-853 of Properties of the Fundamental Interactions. Vol. 9, Pt. C. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From Properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PC).

The study of photon-photon collisions in electron-electron storage rings covers the history of the phenomenon, background suppressions and total cross section, energy dependence and angular distributions, and the effects of realistic experimental cut-offs. (JFP)

33569 PHOTOPRODUCTION OF VECTOR MESONS: EXPERIMENTAL. Rosenfeld, A. H. (Univ. of California, Berkeley); Soeding, P. pp 883-951 of Properties of the Fundamental Interactions. Vol. 9, Pt. C. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From Properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PC).

Some of the newer and more important experimental results on the photoproduction of vector mesons are reviewed. These are discussed in terms of physical arguments rather than density matrix elements. Polarized photon beams, polarization properties of the reactions $\gamma p \rightarrow \omega(\phi)p$, and cross sections of the reactions $\gamma p \rightarrow V^0 p$, test of the vector dominance model, vector meson photoproduction on the deuteron, the reaction $\gamma + A \rightarrow V^0 + A$ on complex nuclei, the phase of the ρ, ω, and ϕ forward elastic scattering, and photoproduction of heavy vector mesons; the $\rho^1(1500)$ are covered. (JFP)

33570 ANGULAR DISTRIBUTIONS OF THE ASYMMETRY OF THE $\gamma p \rightarrow p\pi^0$ REACTION WITH THE γ-QUANTA ENERGIES OF 400, 450, 500, 550, 650 MeV. Ganenko, V. B.; Gorbenko, V. G.; Zhebrovskii, Yu. V.; Kolesnikov, L. Ya.; Miroshnichenko, I. I.; Rubashkin, A. L.; Sanin, V. M.; Sorokin, P. V.; Shalatskii, S. V. (Physical-Technical Inst., Kharkov). Yadern. Fiz.; 20: No. 2, 356-358(Aug 1974). (In Russian).

The asymmetry of the differential cross sections of the $\gamma p \rightarrow p\pi^0$ reaction with polarized γ-quanta. The angular distributions of the asymmetry are obtained for the 60 to 135° c.m. pion angles in the energy range of the primary photons from 400 to 650 MeV. The measurements are made with the linearly polarized photons produced in the coherent bremsstrahlung of high energy electrons in the diamond monocrystal. The experimental results are compared with theory. (auth)

Weak

33571 (CERN-74-15) HADRON PHYSICS AT ISR ENERGIES. Jacob, M. (European Organization for Nuclear Research, Geneva (Switzerland)). 31 Jul 1974. 80p.

These four lectures cover some facets of hadron physics being studied at present at the ISR. Elastic scattering, total cross section, diffraction excitation and large transverse momentum phenomena are discussed in detail. A status report is given on these rapidly developing fields. A complement is made to two previous reviews, the NAL Conference Rapporteur's talk in 1972 and Ebeltoft lecture notes in 1973, rather than a self-contained extensive work on very high energy hadron physics. Emphasis is put on the largely complementary aspect of research at the ISR and at NAL (SPS). (auth)

Strong (Baryon-induced)

33572 MASS OF THE RELICT NEUTRINOS AND THE MISSING MASS PHENOMENA IN THE UNIVERSE. Szalay, A. S.; Marx, G. (Eotvos Univ., Budapest). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 95-101(1974).

Experimentally, the mass of the neutrino is not well known: $m_{\nu_e} < 60$ eV, $m_{\nu_\mu} < 0.8$ MeV. This note discusses astronomical information about these masses, obtained from the normal gravitational interaction of these particles. The early moments of the universe are described, and by using such data as the age of the universe, the Hubble parameters, and the deceleration, it is found that the neutrino rest mass cannot exceed 16 eV. It is noted that the dynamical mass density of the universe is larger than the optically observed mass: this "missing mass" might be explained by a relict neutrino gas possessing a rest mass of the order of 1 eV. As neutrinos lose their kinetic energy, they become unstable for large-scale fluctuations; therefore, the density excess will pull atomic matter to the denser places. The formation of some large visible objects can be explained in this way. The separation of such objects, their mass, radius, and

density distribution can be calculated from a given neutrino mass; they agree surprisingly well with those of galactic clusters. Rough calculations are presented for the Coma cluster. The system is unstable for $m_\nu = 0$, stable for $m_\nu \sim 1$ eV, and nearly singular for $m_\nu \sim 2$ eV. Hence, 2 eV may be considered as an upper limit on the rest mass of the neutrino. All of the astronomical phenomena considered allow a small, but nonzero, neutrino mass of the order of 1 eV. (2 figures) (RWR)

33573 (CONF-740713-26) ANALYSIS OF PROTON–DEUTERON INTERACTIONS AT FERMILAB ENERGIES. Akimov, Y.; Golovanov, L.; Mukhin, S. (Joint Inst. for Nuclear Research, Dubna (USSR)). Aug 1974. 10p. Dep. NTIS $4.00.

From 17th international conference on high-energy physics; London, UK (1 Jul 1974).

A model describing recent experimental results on the reaction $p + d \rightarrow X + d$ between 50 and 400 GeV/c is presented. In the region $M_X^2 < 6$ GeV^2 the essential features of the data can be described by a Deck-type mechanism, while in the high mass region ($6 < M_X^2 < 25$ GeV^2) the data can be described by a triple-Pomeron term. The triple Pomeron term is constructed with finite mass sum rules (FMSR) from elastic and Deck amplitudes. The Pomeron-proton total cross section is found to be about 2 mb at large M_X. The calculation of shadow corrections due to diffractive dissociation are in good agreement with elastic p-d scattering data. (auth)

33574 (RL-74-113) HIGH ENERGY ELASTIC SCATTERING. Phillips, R. J. N. (Science Research Council, Chilton (UK). Rutherford Lab.). Jul 1974. 23p. (CONF-740653-4). Dep. NTIS (U. S. Sales Only) $4.25.

From 9th symposium on particle physics; Balatonfured, Hungary (12 Jun 1974).

High energy data are discussed, together with some general ideas and specific theoretical models. (auth)

33575 HIGH ENERGY HADRONIC COLLISIONS. Wetherell, A. M. (CERN, Geneva). pp 658-724 of Properties of the Fundamental Interactions. Vol. 9, Pt. B. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PB).

Review lectures are given on the progress and development in experimental knowledge of high energy hadronic collisions made during the past year. The subjects covered are total cross sections, two-body processes including elastic and charge-exchange scattering and quasi two-body reactions, inclusive experiments, and secondary particle multiplicity. (JFP)

33576 MEASUREMENT OF THE CROSS SECTION OF INELASTIC NUCLEAR INTERACTIONS IN LEAD AND ALUMINUM BY MEANS OF SPARK CHAMBERS AND IONIZATION CALORIMETER. Bostandzhyan, N. Kh.; Vardumyan, D. T.; Marikyan, G. A.; Matevosyan, K. A. (Erevan Inst. of Physics). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 8: No. 6, 391-394(1973). (In Russian).

The cross sections of inelastic interactions of cosmic ray hadrons of average energies 450 GeV were measured by direct registration of the place of interaction in target between wide-gap spark chambers. The cross sections were found to be $\sigma_{Al} = (398^{+46}_{-38})$ mb and $\sigma_{Pb} = (1670^{+240}_{-200})$ mb in aluminum and lead respectively. (auth)

33577 DIFFERENTIAL CROSS SECTION FOR NEUTRON–PROTON SCATTERING AT 14.1 MeV. Shirato, S.; Saitoh, K. (Rikkyo Univ., Tokyo). J. Phys. Soc. Jap.; 36: No. 2, 331-335 (Feb 1974).

The revised data of the n–p differential cross section at 14.1 MeV were presented. The revised values of the cross section at 8 mean neutron-scattering angles in the range 172.0 to 52.5° in the c.m. system were increased systematically by about 2.3% than the previous values due to the precisely calculated neutron-flux correction. The result of a re-measurement done by using a new polyethylene radiator and a new neutron-source apparatus is in good agreement with the revised data. (auth)

33578 TWO-BODY HYPERON FINAL STATES IN ANTI-PROTON INTERACTIONS AT 2.2 GeV/c. Kwak, N.; Manweiler, J. E.; Nicholas, M. L. (Univ. of Kansas, Lawrence). Nuovo Cim., 23A: No. 3, 610-617(1 Oct 1974).

The reactions $\bar{p}p \rightarrow \bar{\Lambda}\Lambda$, $\bar{\Lambda}\Sigma^0$ + C.C., $\bar{\Sigma}^+\Sigma^+$ and $\bar{\Sigma}^-\Sigma^-$ are studied at 2.2 GeV/c. The cross section, differential cross section, polarization and spin correlations (between the $\bar{\Lambda}$ and Λ hyperons) are discussed. (auth)

33579 ANGULAR CORRELATIONS OF CHARGED PARTICLES IN PROTON–NUCLEON INELASTIC COLLISIONS AT 200 GeV/c. Antonova, M. G. (Inst. of High-Energy Physics, Alma-Ata, USSR); Boos, E. G.; Goryachikh, A. A. JETP Lett. (USSR) (Engl. Transl.); 19: No. 9, 310-312(5 May 1974).

Translated from Zh. Eksp. Theor. Fiz., Pis'ma Red.; 19: No. 9, 598-602(5 May 1974).

The distribution with respect to the quantity $Y = -\ln \tan(\theta/2)$ is presented for pp interactions. The distributions of the rapidity intervals occupied by different numbers of particles yield indications of the correlations of the particles with respect to rapidity in the pionization region. (auth)

33580 MULTIPLE GENERATION OF CHARGED PARTICLES IN INELASTIC INTERACTIONS OF PROTONS AT 200 GeV/c. Alma-Ata–Leningrad–Moscow–Tashkent Collaboration. Yadern. Fiz.; 20: No. 1, 94-100(Jul 1974). (In Russian).

Distributions are presented in multiplicity of charged particles produced in inelastic proton–proton, proton–neutron, and coherent proton–nucleus interactions at 200 GeV/c. The average multiplicities are $\langle n \rangle_{pp} = 8.2 \pm 0.2$, $\langle n \rangle_{pn} = 7.7 \pm 0.2$, $\langle n \rangle_{coh} = 2.7 \pm 0.1$, respectively. Data on multiplicities of particles, emitted in the forward and backward hemispheres, are compared with the hypothesis of limiting fragmentation. The two-component model of the multiple production of particles is considered. The average multiplicities of secondary particles in the pp interactions in the fragmentation and pionization processes are $\langle n \rangle_f = 3.6 \pm 0.1$ and $\langle n \rangle_c = 4.9 \pm 0.15$, respectively. Data on the probability of the low energy proton charge exchange are obtained. (auth)

33581 ANGULAR DISTRIBUTIONS AND CORRELATIONS OF SECONDARY PARTICLES IN pN INTERACTIONS AT THE MOMENTUM OF 200 GeV/c. Alma-Ata–Leningrad–Moscow–Tashkent Collaboration. Yadern. Fiz.; 20: No. 1, 87-93(Jul 1974). (In Russian).

Angular distributions and correlations of secondary charged particles from interactions of 200 GeV/c protons with free and quasi-free nucleons are investigated. The angular distributions are anisotropic in c.m.s. The anisotropy decreases as the multiplicity grows. A nonstatistical nature of the rapidity distribution of the particles is established. Particles with small differences of the rapidities are produced most often. An indication is obtained to that long-range correlations exist in the rapidity region corresponding to the pionization. (auth)

33582 MEASUREMENT OF TOTAL CROSS SECTIONS OF NEUTRON INTERACTIONS WITH PROTONS AND NUCLEI IN 26 TO 54 GeV ENERGY RANGE. Babaev, A. I. (Inst. of Theoretical and Experimental Physics, Moscow); Brakhman, E. V.; Galaktionov, Yu. V. Yadern. Fiz.; 20: No. 1, 71-86(Jul 1974). (In Russian).

The total cross sections of the neutron interactions with protons and nuclei are measured in the energy range of 26 to 54 GeV. It is found that the total neutron-nuclear cross sections decrease when the energy increases in the range under consideration. There is evidence for some energy dependence of the elementary np total cross section. The nucleon-deuterium and nucleon-nucleon total cross sections are used to calculate Glauber corrections to the cross section on deuterium. Glauber theory with inelastic screening describes well all the data if the assumption is made that all nucleon-nucleon or, at least, total np cross sections go on decreasing with energy at 30 to 60 GeV. (auth)

33583 P–D SCATTERING AT HIGH ENERGIES. Overseth, O. E. (Univ. of Michigan, Ann Arbor). pp 359-363 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33584 RAPID HELIUM NUCLEI IN PROTON–NUCLEUS SPALLATIONS AT THE ENERGY OF 200 GeV. Borisenko, A. I.; Goryachikh, A. A.; Kazanskaya, A. P.; Kopzhasarova, K.; Morozova, P. V.; Takibaev, Zh. S.; Titova, N. S. (Kazakh State Univ., USSR). Yadern. Fiz.; 20: No. 2, 395-397(Aug 1974). (In Russian).

Rapid He nuclei produced in spallations of heavy emulsion nuclei induced by protons with the momentum of 200 GeV/c, are investigated. It is noted that the production cross section, the energy and angular distributions do not depend on the energy of the incident proton. (auth)

33585 SOME CHARACTERISTICS OF THE TRACES OF SECONDARY PARTICLES IN DISINTEGRATION OF PHOTO-EMULSION HEAVY NUCLEI INDUCED BY HIGH ENERGY PIONS AND PROTONS. Takibaev, Zh. S.; Morozova, P. V.; Titova, N. S. (Kazakh State Univ., USSR). Yadern. Fiz.; 20: No. 2, 392-394 (Aug 1974). (In Russian).

Some average characteristics and angular distributions of thin, grey and black traces from disintegrations induced by 7.5 and 17.5-GeV pions and by 67-GeV protons. (auth)

33586 SCATTERING OF POLARIZED PROTONS WITH THE MOMENTUM OF 2.1 GeV/c ON CARBON NUCLEI AND THE CLOSURE APPROXIMATION. Zhurkin, V. V.; Ivanchenko, I. M.; Kanavets, V. P.; Karpenko, N. N.; Kondratyuk, L. A.; Levintov, I. I.; Martynov, V. I.; Mikhailov, O. E.; Morozov, B. V.; Polyakova, L. M.; Ryl'tsov, V. V.; Solov'ev, V. V.; Chvyrov, A. S.; Cherkalina, T. S. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 20: No. 2, 362-370(Aug 1974). (In Russian).

Results are presented on measurements of the differential cross section and the azimuthal asymmetry in elastic and inelastic scattering of partially polarized protons with the momentum of 2.1 GeV/c on carbon nuclei in the angle range 25 to 150 mrad. The measurements were fulfilled at the ITEP accelerator using the technique of wire spark chambers. The obtained results are considered theoretically in framework of the diffraction theory of multiple scattering using the "closure" approximation. On basis of the experimental data and the theoretical analysis the polarization in the pn elastic scattering is estimated at the proton momentum of 2.1 GeV/c. (auth)

33587 MOMENTUM SPECTRUM OF K^0-MESONS PRODUCED BY 70-GeV PROTONS ON Al NUCLEI. Vestergomyi, D.; Vovenko, A. S.; Genchev, V. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 20: No. 2, 371-375(Aug 1974). (In Russian).

The momentum spectrum is obtained of K^0-mesons produced by 70-GeV protons in Al target under the angle of 1° at the Serpukhov accelerator. The form of the spectrum was approximated by means of two functions, one dependent of the kaon transversal momentum only and another dependent on the transversal momentum and the scaling variable X. The experimental data are in agreement with both the theoretical functions. The kaon spectra at the energies of 19.2, 24 and 70 GeV are compared. It is established that the shape of the spectrum is essentially independent on the primary proton energy inside the given limits. (auth)

33588 CORRELATIONS BETWEEN THE RAPIDITIES OF TWO CHARGED PARTICLES IN CENTRAL REGION OF PP INTERACTIONS AT 69 GeV/c. Babintsev, V. V.; Biyumenfel'd, G.; Bogolyubskii, M. Yu. (Inst. of High Energy Physics, Sverdlovsk, USSR). Yadern. Fiz.; 20: No. 2, 376-383(Aug 1974). (In Russian).

The correlations between two charged particles in the central region of pp interactions are studied at 69 GeV energy. The data obtained for the correlations between all charged particles are compared with the published ISR data. The value of correlation for $y_1 = y_2 = 0$ at $\sqrt{s} = 11.5$ GeV equals 0.60 ± 0.05 and within the errors coincides with the ISR value. The positive short-range correlations observed in the $(\pi^-\pi^-)$ and $(\pi^+\pi^+)$ systems appeared to be of comparable orders of magnitude and essentially smaller than the correlations in the $(\pi^+\pi^-)$ system. This fact is evidence for possible existence of intermediate products with small masses which are the main source of π mesons. (auth)

33589 COHERENT GENERATION OF PARTICLES AT EMULSION NUCLEI WITH THE AID OF 50 GeV PROTONS. Azimov, S. A.; Gulamov, K. G.; Svechnikova, L. N.; Chernova, L. P.; Chernov, G. M. (Physico-Technical Inst., Tashkent). Sov. Phys.—Dokl. (Engl. Transl.); 18: No. 10, 662-663(Apr 1974).

Translated from Dokl. Akad. Nauk SSSR; 212: No. 6, 1323-1325 (Oct 1973).

The cross sections of single-, three-, and five-ray channels of coherent proton interactions at intermediate energies of 50 GeV were reported. The energy dependence of the cross section of the three-ray channels was determined. It is found that the cross sections of three-ray coherent proton reactions increase less rapidly than the cross sections of pion reactions. (JFP)

Strong (Meson-induced)

Refer also to abstract 32271.

33590 (IFVE-SEF-73-63) MEASUREMENT OF CROSS SECTIONS FOR INCLUSIVE REACTIONS $\pi^- + p \to \pi^- + X^+$ IN THE REGION OF BEAM FRAGMENTATION AT THE MOMENTA 42 AND 51 GeV/c. Derevshchikov, A. A.; Dmitrievskii, Yu. P.; Matulenko, Yu. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 12p. (In Russian). INIS.

The inclusive cross sections in the reactions $\pi^- + p \to \pi^- + X^+$ were measured at momenta of 42 and 51 GeV/c, at values of the square of the transmitted momentum $P_\perp^2 = 0.04$ to 0.26 $(GeV/c)^2$, and for the interval $X = P/P_{max} = 0.90$ to 0.99. With increase of X in the interval studied, an increase of the invariant differential cross section was observed at a fixed $P_\perp^2$. In the Regge model such behavior can be explained by the preponderant contribution of the vacuum pole. Under this assumption the energy dependence of the total interaction cross section of the pomeron with protons was found for some values of $P_\perp^2$. (tr-auth)

33591 (JINR-P1-8141) MULTIPLICITY DISTRIBUTION OF π^0, K^0, AND Λ^0 PRODUCED IN π^-p INTERACTIONS AT 40 GeV/c. Amaglobeli, N. S.; Grishin, V. G.; Dzhmukhadze, S. V.; Ikov, N.; Kladnitskaya, E. N.; Popova, V. M.; Sabeu, M.; Tevzadze, Yu. V.; Tsivtsivadze, E. T.; Chargeishvili, M. S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Available experimental data on the multiplicity of secondary particles (π^+, π^0, K^0, and Λ^0) in a wide interval of energies (10 to 300 GeV) were analyzed for π^-p, pp, and $\bar{p}p$ interactions. The results showed that in this energy interval multiplicity scaling takes place. For form of the function ψ does not depend on the type of primary particle (p, π, or $\bar{p}$). (tr-auth)

33592 SEARCH FOR CHARGE ASYMMETRY IN ETA PRIME DECAY. Grigorian, A. Los Angeles; Univ. of California (1974). 157p. University Microfilms Order No. 74-20,270.

Thesis (Ph. D.).

Charge conjugation (C) invariance in the electromagnetic interaction involving hadrons was tested by searching for asymmetry in the π^+-π^- energy spectra resulting from the electromagnetic decay of the η' (958) meson $\eta' \to \pi^-\pi^+\gamma$. In this experiment, the η' mesons were produced in the reaction $\pi^-p \to \eta'/\eta,\eta\pi^-\pi^+\gamma$. The beam momentum was 2.1 GeV/c, the value for which the η' production cross section is maximum. The value of α obtained from these η' events was $\alpha = (-6.00 \pm 6.53)\%$ so that no C-violation was observed in this experiment. According to the calculation of Barrett and Truong, this is equivalent to an η experiment in which the precision for measuring α is 0.2%. (Diss. Abstr. Int., B)

33593 πd BACKWARD SCATTERING VIA ISOBARS IN THE DEUTERON. Klem, G. J.; Weber, H. J. (Virginia Univ., Charlottesville (USA). Dept. of Physics). Z. Phys.; 268: No. 3, 299-306(Jun 1974).

7 figs.; 3 tabs.; 15 refs.

Pion-deuteron elastic backward scattering at pion laboratory momenta between 0.2 and 1.0 GeV/c analyzed in terms of a two-particle exchange mechanism. Inclusion of isobars $\Delta(1236)$ in the intermediate states, such that the initial or final deuteron is in a $\Delta\Delta$ configuration, produces qualitative agreement with the observed structure of the excitation function. Intermediate N'(1520) and N'(1535) states are found to be negligible. (auth)

33594 ANALYSIS OF ANGULAR DISTRIBUTIONS OF VIRTUAL PION SCATTERING ON PROTON IN THE REACTION $\pi^-p \to \pi^-p\pi^+\pi^-$ AT 4.5 GeV/c. Beketov, G. V.; Zombkovskii, S. M.; Kaidalov, A. B.; Konovalov, B. S.; Korolev, Yu. V.; Kruchinin, S. P.; Selektor, Ya. M.; Turov, V. F.; Shulyachenko, V. N. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 20: No. 1, 64-70(Jul 1974). (In Russian).

Angular distributions of virtual pion scattering on proton in the reaction $\pi^-p \to \pi^-p\pi^+\pi^-$ at the primary pion momentum of 4.5 GeV/c are studied by means of hydrogen bubble chambers. It is shown that after selection of the events with small 4-momentum transfer squared ($t' < 0.3$ (GeV/c^2)) the contribution from the background graphs is changed in wide limits from 20 up to 90%. In the region where this contribution is small (the π^-p scattering) the angular distributions on and off the mass shell are consistent. In region of the high π^+p masses, where the contribution from the background graphs is essential (up to 90%), the angular distributions are reasonably described by the Regge pole exchange model. The presented results show a dominating role of the one-pion exchange in the studied reaction. (auth)

33595 ANISOTROPIES IN ADAIR DISTRIBUTIONS FOR THE REACTION $K^-p \to X^0\Lambda$. Zaslavskii, A. N.; Lednitski, R.; Ogievetskii, B. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 20: No. 1, 213-209(Jul 1974). (In Russian).

Possible spin anisotropies in Adair distributions for the $K^-p \to X^0(960)\Lambda$ reaction are discussed. There are two three-particle decay modes, therefore six main distributions exist. The recent Brookhaven data have shown that three of those distributions are anisotropic. The values of the remaining anisotropies are predicted. Study of those correlations which are only due to the momentum conservation will make it possible to give an answer "yes" or "no" to the question whether the $X^0(960)$ meson spin-parity is 2^-. Closer to the threshold of the reaction $K^-p \to X^0\Lambda$ the anisotropy may be large even for not very small scattering

angles. It is emphasized that the analysis of only Dalitz plots cannot give a definite answer. (auth)

33596 SPARK CHAMBER MEASUREMENT OF THE REACTIONS $\pi^{\pm} + p \rightarrow \rho^{\pm} + p$ AT 15 GeV/c. Pratt, J. C. Stanford, CA; Stanford Univ. (1974). 92p. University Microfilms Order No. 74-20,227.

Thesis (Ph. D.).

The reactions $\pi^{\pm} + p \rightarrow \pi^{\pm} + \pi^0 + p$, $\pi^0 \rightarrow \gamma + \gamma$ were studied at 15 GeV/c in the square of the four-momentum transfer (t) range $0 \leq |t| \leq 1.0$ (GeV/c)^2, with principal emphasis on the low-t $0 \leq |t| \leq 0.08$ (GeV/c)^2. The apparatus used was an optical spark chamber spectrometer in which some of the plates were of solid dense material to convert the gamma rays from the neutral pion's decay. By reconstructing the event from the charged pion and the gamma rays the complications of detecting low energy protons were avoided. The density matrix elements ρ_{ij}^{α} are extracted for the rho mass region $665 \leq m(\pi^{\pm}\pi^0) \leq 865$ MeV; and the differential cross sections for the ρ^+ and ρ^- are obtained. No statistically significant structure in the forward cross section is observed, in contrast to other measurements of these cross sections in bubble chambers. The ρ^+ and ρ^- cross sections presented are nearly identical. Calculations are made in a one-particle exchange model for both π and ω exchanges, with the addition of absorptive corrections. Exact partial wave expansions are obtained for both exchanges and the qualitative behavior for very simple absorptive assumptions is investigated. The major features of the pion exchange density matrix elements are obtained with very simple assumptions, but the cross section features for both π and ω exchange require very heavy absorption of the lowest, closest, partial waves. (Diss. Abstr. Int., B)

33597 PHOTOPRODUCTION OF RHO MESONS FROM HYDROGEN AND DEUTERIUM FROM 9 GeV TO 16 GeV. Giese, R. F. Stanford, CA; Stanford Univ. (1974). 168p. University Microfilms Order No. 74-20,194.

Thesis (Ph. D.).

Rho photoproduction from hydrogen and deuterium for energies between 9 and 16 GeV was studied using a wire spark chamber spectrometer. Density matrix elements describing the decay angular distribution of the rho are presented. The momentum transfer dependence of these matrix elements confirms s-channel helicity conservation for momentum transfers out to -0.3 (GeV/c)^2 and over the full energy range covered by this experiment. The data are compared with the Söding model and all differential cross sections as well as mass distributions are presented within the context of this model, for all energies. The ratio of differential cross sections from deuterium and hydrogen is presented as a function of momentum transfer and is found to be consistent (at all energies) with no I = 1 exchange. However a small amount of I = 1 exchange is favored. The shape of the differential cross sections as a function of energy is consistent with Regge shrinkage. Finally, the differential cross sections are compared with pion-nucleon elastic scattering and with Compton scattering in the spirit of the quark model and vector meson dominance. While the rho and Compton differential cross sections are found to agree in shape only, the rho and pion-nucleon differential cross sections are found to agree in both shape and magnitude. (Diss. Abstr. Int., B)

33598 ANALYSIS OF SPIN AND PARITY OF THE B MESON AT THE MOMENTUM OF 4.5 GeV/c. Dubovikov, M. S.; Erofeev, I. A. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 20: No. 2, 428-432(Aug 1974). (In Russian).

Results are presented of spin-parity analysis of the $\omega\pi$-system from the reaction $\pi^-p \rightarrow p\pi^-\omega^0$ at 4.5 GeV/c. Various J^P states are discussed. The quantum numbers $J^P = 1+$ are preferable for the B meson. (auth)

33599 INCLUSIVE REACTIONS WITH γ QUANTA IN π^-p, $\pi^{-12}C$ INTERACTIONS AT p = 40 GeV/c. Budapest-Bucharest-Warsaw-Dubna-Krakow-Moscow-Sofia-Tashkent-Tbilisi-Ulan Bator-Hanoi Collaboration. Yadern. Fiz.; 20: No. 2, 384-391(Aug 1974). (In Russian).

Some results of the inclusive spectra of γ quanta and π^0 mesons in π^-p and $\pi^{-12}C$ interactions at 40 GeV/c are presented. It is shown that no factorization of the structure function $f(q_\perp, x)$ in the $q_\perp$ and x variables is observed in the reaction $\pi^-p \rightarrow \gamma + \ldots$ for $q_\perp \leq 0.4$ GeV/c and $|x| \leq 0.16$. The method of statistical regularization was applied to obtain the spectrum of the longitudinal momenta of π^0 mesons in the c.m.s. by the measured γ spectra. It is obtained that in the region $-0.02 \leq x \leq 0.02$ $N_{\pi^+} + \approx N_{\pi^-} \approx N_{\pi^0}$ within $\pm$ 7% accuracy. The comparison of the inclusive γ spectra in π^-p and $\pi^{-12}C$ interaction has shown that the normalized structure functions are the same for both reactions in the central region and in the region of the pion fragmentation. (auth)

Particle Interactions and Properties (Theoretical)

General

33600 (IC-74/55) IMPACT OF QUANTUM GRAVITY THEORY ON PARTICLE PHYSICS. Salam, A. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1974. 26p. (CONF-740234-1). Dep. NTIS (U. S. Sales Only) $4.50.

From conference on general relativity and particle physics; Oxford, UK (Feb 1974).

Ideas of space-time curvature and torsion have influenced some recent thinking in particle physics. A review of these developments is presented. (auth)

33601 (INS-PT-27) NOTE ON RELATIVISTIC STRING MODEL. Goto, T. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jan 1974. 60p. (In Japanese). NTIS (US Sales Only).

Several problems related to the relativistic string model are discussed. Emphasis is placed upon those aspects of the string model which have not been treated in detail in existent review articles. First a brief introduction is given to the classical formulation of the string model. The electromagnetic interaction of the relativistic string is then discussed. An attempt is made to formulate the string–string interaction based on the dynamical string picture rather than on the conventional duality requirements. No discussions on the no-ghost theorem are given. Because of the informal nature of these lectures, it was not attempted to tabulate a complete list of references. (auth)

33602 (JINR-E2-8128) PROJECTILE PROPERTIES OF THE QUASIPOTENTIAL GREEN FUNCTIONS OF COMPOSITE PARTICLES. Kuleshov, S. P.; Kvinikhidze, A. N.; Matveev, V. A.; Sisakyan, A. N.; Slepchenko, L. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 17p. Dep. NTIS (US Sales Only) $4.00.

A method is presented for studying projective properties of the Green functions within the quasipotential formalism. (auth)

33603 (JINR-P2-8108) SOME SYMMETRY PROPERTIES OF THE DECAY CONSTANTS AND FORMFACTORS IN THE INVARIANT DECOMPOSITIONS OF THE SPECTRAL FUNCTIONS OF THE MATRIX ELEMENTS $\langle 0|[V_\mu^a(x), V_\nu^b(0)]|s_{\gamma^*}(p)\rangle$ AND $\langle 0|[V_\mu^a(x), V_\nu^b(0)]|v_{\gamma^*}(p,\lambda_{\gamma^*})\rangle$. Fakirov, D. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 20p. (In Russian). Dep. NTIS (U. S. Sales Only) $4.00.

Some symmetry properties of decay constants and form factors (invariant functions of transfered momentum) introduced previously are explored. They appear there in connection with a consistently developed approach for finding in an explicit form local expressions for the spectral functions of the matrix elements $\langle 0|[V_\mu^a(x), V_\nu^b(0)]|s_{\gamma^*}(p)\rangle$ and $\langle 0|[V_\mu^a(x), V_\nu^b(0)]|v_{\gamma^*}(p,\lambda_{\gamma^*})\rangle$. (auth)

33604 PROPERTIES OF THE FUNDAMENTAL INTERACTIONS. Volume 9, Part B. 1971 International School of Subnuclear Physics, Erice, Trapani, Sicily, July 8–26, 1971. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973). 347p. (CONF-710744-(P9)(PB)).

Separate abstracts were prepared for the eight lectures included. (JFP)

For abstracts of individual lectures see: 33575, 33605, 33642, 33664–33666, 33676, and 33704.

33605 INELASTIC PROCESSES. Gasiorowicz, S. (Univ. of Minnesota, Minneapolis). Contract AT(11-1)-1764. pp 624-657 of Properties of the Fundamental Interactions. Vol. 9, Pt. B. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PB).

Lectures are given to survey briefly some recent theoretical points of view that are currently being used to guide experimental research in the field of multiparticle production. Included are kinematics, the multiperipheral point of view, limiting distributions and diffractive processes, and the extension of Reggeism to inclusive reactions. (JFP)

33606 CONNECTION BETWEEN SINGULARITY STRUCTURE OF CASUAL DISTRIBUTION AND BEHAVIOR IN THE BJORKEN LIMIT. Kuehn, J. (Max-Planck-Institut fuer Physik und Astrophysik, Munich). Nuovo Cim., 23A: No. 3, 420-430(1 Oct 1974).

Different definitions of the Bjorken limit are compared. Only for sufficiently smooth "scaling functions" are the three definitions equivalent. Singularities in the timelike region do not contribute in

the suitably defined limit. The contribution of an arbitrary singularity in the Bjorken limit is given. (auth)

33607 ANALYSIS OF DIFFRACTION FORMULAS. Gersten, A. (Univ. of the Negev, Beersheva, Israel). Nuovo Cim., 23A: No. 3, 494-520(1 Oct 1974).

Various diffraction formulae describing elastic scattering of spinless uncharged particles are analyzed. Expressions for the l-dependence of the S-matrix elements of boundary condition models are derived and compared with direct S-matrix models. Some incompatibility between the two different approaches, which are supposed to describe the same phenomenon, are found. In the derivation of Kirchhoff's diffraction formula there exists an incompatibility of the boundary conditions. Namely, for its derivation one should know both the values of the wave function and the normal component of the gradient of the wave function on the absorbing sphere. The solutions to both boundary problems are separately presented. The reflection from the absorbing sphere is treated and new formulae are derived. The differential and total cross-sections of the described models are analyzed. (auth)

33608 QUARK MOLECULES. Dolgov, A. D.; Zakharov, V. I.; Okun, L. B. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 20: No. 1, 199-202(Jul 1974). (In Russian).

Nonrelativistic quark model with three triplets and octet of colored gluons is considered. The interaction energy is calculated for some quark molecules. It is shown that states of the type $qq\bar{q}\bar{q}$ and $qqqq\bar{q}$ are bounded more tightly than $q\bar{q}$ and qqq, respectively. This may indicate an existence of exotic particles in the nature or, perhaps, to that the model is invalid. (auth)

33609 MULTIPERIPHERAL MODEL IN ASYMPTOTICAL KINEMATICS. Dubovikov, M. S. (Moscow Physical-Technical Inst.). Yadern. Fiz.; 20: No. 1, 169-180(Jul 1974). (In Russian).

The multiperipheral diagram is considered provided the distance y between unreducible blocks in the "rapidity" frame considerably exceeds the unity. The total cross section is calculated. A reggeized version of the model is treated for the case when the unreducible blocks are the resonant states (as, e.q. in the thermodynamical model). The multiplicity distribution and the energy distribution of the unreducible blocks are obtained, the mean multiplicity and the dispersion of the number of particles and number of blocks distributions are evaluated. The possibility is discussed to compare some of the results with data. (auth)

33610 PROPERTIES OF THE FUNDAMENTAL INTERACTIONS. Volume 9, Part C. 1971 International School of Subnuclear Physics, Erice, Trapani, Sicily, July 8-26, 1971. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973). 303p. (CONF-710744-(P9)(PC)).

Separate abstracts were prepared for each of the eight lectures included. (JFP)

For abstracts of individual lectures see: 33567-33569, 33611, 33678, 33690, 33699, and 34099.

33611 COHERENT INTERACTIONS. Pevsner, A. (Johns Hopkins Univ., Baltimore). pp 857-881 of Properties of the Fundamental Interactions. Vol. 9, Pt. C. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From Properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PC).

The review of coherent interactions covers kinematics, coherence, experimental detection of coherent reactions, some experimental results, and coherent pion production from complex nuclei. (JFP)

33612 STRUCTURE OF THE 12J AND 15J COEFFICIENTS IN THE BARGMANN APPROACH. Huang, C. S.; Wu, A. C. T. (Univ. of Michigan, Ann Arbor). J. Math. Phys. (N. Y.); 15: No. 9, 1490-1493(Sep 1974).

Generating functions of the 12j and 15j angular momentum recoupling coefficients are computed explicitly in the Bargmann formalism. Symmetry properties are deduced therefrom. A geometrical Möbius strip representation (originally due to Ord-Smith for the 12j case), which can be generalized to all n, suggests a 4n-fold symmetry for the 3nj coefficients ($n \geq 4$). (auth)

33613 GENERAL PROPERTIES OF REPRESENTATIONS OF LOCAL CURRENTS AT INFINITE MOMENTUM. Divakaran, P. P. (Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, France). Ann. Phys. (N. Y.); 84: No. 1-2, 303-317(15 May 1974).

The results of an earlier work on the representations of currents on the physical Hilbert space are extended to "representations at infinite momentum." A detailed construction of the infinite momentum representation space in a proper basis is given, and it is shown that irreducible subspaces correspond uniquely to irreducible subspaces of the physical Hilbert space. The internal symmetry spectrum in each irreducible representation is unbounded, and the mass spectrum is unbounded and continuous from some point onward if it is not strictly degenerate. Representations of free-field currents are given special attention. (auth)

33614 NONDYNAMICAL STRUCTURE OF REACTIONS INVOLVING FOUR SPIN-½ PARTICLES. Reid, R. V. Jr. (Univ. of California, Davis); Moravcsik, M. J. Ann. Phys. (N. Y.); 84: No. 1-2, 535-558(15 May 1974).

The complete spin-structure of the reaction involving four spin-½ particles is given, and the consequences of the imposition of various conservation laws are described. The latter yield a complete set of experimental tests for the validity of the conservation laws. (auth)

33615 COMPOSITE MODEL OF ELEMENTARY PARTICLES AND DEEP INELASTIC SCATTERING. Senju, H. (Nagoya Univ., Japan). Progr. Theor. Phys. (Kyoto); 51: No. 3, 956-957(Mar 1974).

The author's original model of elementary particles could not explain experiments on neutrino production. The model is modified in this paper to take care of the difficulty. To explain $\nu(\bar{p})$ production two points must be improved: nucleons must be constructed without urbaryons, and anti-particles in urbaryons must be replaced by particles with the same charge and spin. The former is accomplished by extending a single-quartet model to a two- or three-quartet model. The consequences of this are discussed for hadron symmetry, $e + N \rightarrow e +$ anything, $\nu_\mu(\bar{\nu}_\mu) + N \rightarrow \mu^-(\mu^+) +$ anything, and the heavy lepton. The possibility $Q_{\nu_1^+} = \frac{2}{3}$ cannot be definitely excluded. (1 figure, 1 table) (RWR)

Electromagnetic

Refer also to abstracts 33797 and 34095.

33616 (DESY-74/24) DUAL QUARKS AND PARTON QUARKS. Kitakado, S. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). May 1974. 23p. (CONF-740332-5). Dep. NTIS (U. S. Sales Only) $4.25.

From 9th Rencontre de Moriond conference; Meribel-les-Allues, France (3 Mar 1974).

The constraints of duality are imposed on the structure functions of total as well as one particle inclusive deep inelastic electron-nucleon scattering. (auth)

33617 (DESY-74/26) ISOSPIN BOUNDS AND BOSE CONDENSATION IN e^+e^- ANNIHILATION. Schiller, D. H.; Devenish, R. C. E.; Koller, K.; Walsh, T. F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Jun 1974. 7p. INIS.

2 figs.; 13 refs. With abstract.

Isospin bounds are derived for two particle correlations in $e^+e^- \rightarrow \gamma \rightarrow N\pi$, the physical significance of saturation of the upper bound is discussed, and various multiplicity distributions for this case are presented. (auth)

33618 (EFI-30-73) APPLICABILITY OF TRANSITION RADIATION FORMULAE. Muradyan, M. M. (Erevanskij Fizicheskij Inst. (USSR)). 1973. 10p. (In Russian). INIS.

Some curves of the spectral distribution of the number of quanta of transition radiation, calculated with different formulas of transition radiation in the x-ray frequency region during perpendicular flight of extremely relativistic charged particles through a stack of foils, were reported. On the basis of curves the correctness of the conditions of applicability of the transition radiation formulas was numerically shown. (tr-auth)

33619 (JINR-P2-8020) UNIFIED DISPERSION MODEL FOR SINGLE PION PHOTOPRODUCTION AND RELATED PROCESSES IN THE $\Delta(3/2),3/2)$-RESONANCE REGION. Blokhintseva, T. D.; Surovtsev, Yu. S.; Tkebuchava, F. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 25p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Processes $\gamma N \rightarrow \pi N$, $eN \rightarrow e\pi N$ and $\pi N \rightarrow e^+e^-N$ are considered in the framework of the dispersion relations at the $\Delta(3/2, 3/2)$-resonance. A possibility of the determination of pion and nucleon electromagnetic form factors is discussed. (auth)

33620 (KHFTI-73-10, pp 34-37) ELASTIC PHOTOPRODUCTION OF π^0 MESONS ON DEUTERIUM. Krementsova, Yu. N.; Lebedev, A. I. (Lebedev Inst. of Physics, Moscow). 1973. (In Russian).

The process $\gamma + d \rightarrow d + \pi^0$ was theoretically examined in the photon energy region from 250 to 900 MeV. The cross section of

the process in the center-of-mass system was calculated in the impulse approximation. The angular and energy dependences of the differential cross sections obtained were shown. Comparison of the calculations made with experimental data at energy of the photoexcitation of the first $P_{33}(1238)$ and second $D_{13}(1525)$ confirmed the isovector character of the photoexcitation of the second resonance. (INIS)

33621 (KHFTI-73-10, pp 48-50) ISOTENSOR COMPONENT OF HADRON ELECTROMAGNETIC CURRENT AND THE FORMATION OF π^0 MESONS BY PHOTONS ON DEUTERIUM. Govorkov, B. B.; Krementsova, Yu. N.; Lebedev, A. I.; Polishchuk, B. F. (Lebedev Inst. of Physics, Moscow). 1973. (In Russian).

The possibility of obtaining information of the isotensor current during investigation of the processes $\gamma + d \rightarrow d + \pi^0$ (1) and $\gamma + d \rightarrow p + n + \pi^0$ (2) was discussed. Expressions were obtained for the differential cross sections of these processes. Consideration of the isotensor A^T component of the amplitude leads to an effective decrease of the cross section of process (1) in the energy region for the photoexcitation of the resonance $\Delta_{33}(1236)$. For the processes $\gamma + p \rightarrow p + \pi^0$ (3) and $\gamma + n \rightarrow n + \pi^0$ (4) a proposal is made to determine the contribution of the isotensor components by measurement of the size of the parameter $a = [(d\sigma/d\Omega)(\gamma p) - (d\sigma/d\Omega)(\gamma n)]/[(d\sigma/d\Omega)(\gamma p) + (d\sigma/d\Omega)(\gamma n)]$. In the absence of an isotensor contribution the cross sections of the processes (3) and (4) at E_γ = 300 to 350 MeV are close in size. Thus for flight angle of the π^0 meson of $\theta = 90°$ in the center-of-mass $a = 0.003$ at E_γ = 320 MeV and $a = 0.0015$ at E_γ = 340 MeV. The presence of the isotensor component $A^T \approx 0.1$ A increases the parameter a up to ≈0.2. (INIS)

33622 (ORO-3992-181) UNIFIED THEORY OF WEAK AND ELECTROMAGNETIC INTERACTIONS WITH ONE SINGLE COUPLING CONSTANT. Hsu, J. P.; Sudarshan, E. C. G. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 13p. (CPT-225). Dep. NTIS $4.00.

A unified theory of weak and electromagnetic interactions is discussed. The theory involves the 4-vector fields W_μ, Z_μ, A_μ and the experimentally established leptons. The dynamics of interactions among these physical particles is characterized by one single coupling constant. The theory is covariant, renormalizable, unitary and "gauge independent." All these come about because dynamics and symmetry are interlocked in a simple way. These are to be contrasted with those in the Weinberg unified theory for leptons in which there are, in addition, the Higgs scalars with complicated interactions, and the dynamics of interactions among physical particles is characterized by five different coupling constants. (auth)

33623 (SAND-74-8220) ETAGEN: A CODE FOR DETERMINING BOUNDARY CONDITIONS FOR A PROBLEM IN MULTIPLE SCATTERING IN A SEMI-INFINITE REGION. Huddleston, R. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Sep 1974. Contract AT(29-1)-789. 28p. Dep. NTIS $4.50.

In solving the Boltzmann equation for the multiple scattering of charged particles in a semi-infinite medium, there are certain conditions which must be satisfied at the boundaries ($x = 0$ and $x = \infty$). Using the Laplace transformation method, coupled with truncated Legendre expansions, leads to systems of matrix equations for the boundary conditions which must be solved frequently, and therefore efficiently. A study was made on the properties of these matrices and the results implemented in a program, ETAGEN, which solves for the boundary conditions. (auth)

33624 DISPERSION EQUATION IN THE THEORY OF TRANSITION RADIATION PRODUCED IN A STACK OF PLATES. Avakyan, A. L.; Garibyan, G. M.; Yang, C. (Erevan Inst. of Physics). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 1, 12-23(1974). (In Russian).

A simple derivation of exact formulas for the radiation produced by a charge in a laminar medium of infinite and finite length is given. The relation between these formulas is obtained. The role of the dispersion equation in the radiation production in a laminar medium is shown. In x-ray frequency range narrow and high maxima may arise if the radiation wavelength is of the order of the period of laminar medium. (auth)

33625 ELECTROMAGNETIC MECHANISM OF W-BOSON PAIR PRODUCTION BY HIGH-ENERGY PARTICLES. Ter-Isaakyan, N. L.; Khoze, V. A. (Erevan Inst. of Physics). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 1, 3-11(1974). (In Russian).

The theoretical total cross sections for W-boson pair photo- and electroproduction processes on nucleon and nucleus are obtained in the asymptotic energy reg'on. The calculations are carried out by means of the covariant formulation of the Weizslicker-Williams method. The features of the application of this method to the W-boson production processes are discussed. (auth)

33626 QUANTUM EFFECTS AT THE INTERACTION OF ELECTRONS WITH PLANE ELECTROMAGNETIC WAVE IN THE MEDIUM. Oganesyan, S. G.; Avetisyan, G. K. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 8: No. 6, 396-404 (1973). (In Russian).

The quantum mechanical motion of spin ½ particle in the plane monochromatic electromagnetic field in the medium is discussed. The exact wave function in the case of circular polarization of the wave and the primary velocity of electron directed along the wave propagation is obtained. The split of energy levels leads to new frequencies in scattering processes. (auth)

33627 THEORY OF UNDULATOR RADIATION. Korkhmazyan, N. A. (Armenian Pedagogical Inst., Erevan). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 8: No. 6, 405-411(1973). (In Russian).

The formula for the spectral distribution of undulator radiation in "strong" fields is obtained. (auth)

33628 MESON EXCHANGE EFFECTS IN BACKWARD DEUTERON ELECTRODISINTEGRATION. Mosconi, B.; Ricci, P. (Univ., Florence). Nuovo Cim., 23A: No. 3, 401-419(1 Oct 1974).

It is shown that the exchange current contributions to the cross section for backward e-d inelastic scattering near threshold are of fundamental importance to get a satisfactory agreement with experimental data at large momentum transfer. In fact the impulse approximation cross section, with the ^3D-component of deuteron state properly taken into account, is much smaller than the experimental one. It is pointed out that some uncertainty affects the kinematic conditions of the Stanford measurements. Thus the calculations have been made of relative n-p kinetic energy E = 3 MeV, and also at E = 6 MeV with the P-wave channel open. These last results are preliminary because the outgoing nucleons have been treated as noninteracting in P-wave states. However these P-wave transitions allow us to get agreement also with the lowest-q^2 experimental point. Moreover the dependence of the theoretical cross section on the nucleon-nucleon potential model has been investigated. (auth)

33629 APPLICATION OF THE EIKONAL METHOD TO HIGH-ENERGY ELECTRON-NUCLEUS SCATTERING. Murphy, J. D. Washington, DC; Catholic Univ. of America (1974). 240p. University Microfilms Order No. 74-19,504.

Thesis (Ph. D.).

Recent improvements in the design of electron linear accelerators have enabled experimentalists to use high energy (greater than 300 MeV) electron/positron beams as probes for uncovering details of nuclear structure which were hitherto inaccessible. The measured cross sections can be used to test models which describe the electromagnetic properties of the nucleus. In order to accurately calculate the electron-nucleus scattering cross section, one must in general take into account the distortion of the incident electron/positron wave by the static Coulomb field of the target nucleus. For example, even in the case of ^{27}Al the plane-wave Born approximation is inadequate. The eikonal (high energy) approximation of Yennie et al., for the scattering of electrons from nuclei is extended to include the transverse interaction, and in particular the case of magnetic scattering. A computer code for elastic and inelastic scattering is prepared, and is applied to the study of various nuclei. A comparison of results with measured data and phase-shift calculations reveals that the eikonal method can accurately describe Coulomb distortion effects if the scattering angle and incident electron energy are sufficiently large. The results should be useful for the interpretation of experiments with heavy elements and for higher electron energies where phase-shift analysis may become cumbersome and unreliable. (Diss. Abstr. Int., B)

33630 ELECTROMAGNETIC FORM FACTOR OF THE PROTON AND HEAVY HYPOTHETICAL PARTICLES. Bilen'kaya, S. I.; Bilen'kii, S. M.; Kazarinov, Yu. M.; Lapidus, L. I. (Joint Inst. for Nuclear Research, Dubna, USSR). JETP Lett. (USSR) (Engl. Transl.); 19: No. 9, 317-318(5 May 1974).

Translated from Zh. Eksp. Theor. Fiz., Pis'ma Red.; 19: No. 9, 613-616(5 May 1974).

The experimental data on elastic ep scattering are analyzed. Simple pole parametrizations of the form factors are obtained, and make it possible to describe all the known data. The possible influence of a hypothetical gluon on the form factor is discussed. (auth)

33631 DIAGRAM TECHNIQUE FOR EVALUATION OF NONLINEAR PERCEPTIBILITIES. Demikhovskii, V. Ya.; Kopasov,

A. P. (Gorky State Univ., USSR). Teor. Mat. Fiz.; 20: No. 2, 265-273(Aug 1974). (In Russian).

Rules of diagram technique for the evaluation of quadratic perceptibilities at $T = 0$ and $T \neq 0$ are formulated. At $T \neq 0$ nonlinear perceptibilities are obtained by means of analytic continuation of the Matsubara function $K^c(\omega_{n_1},\omega_{n_2})$. Analytic continuation with respect to two frequencies can be performed in every single diagram in the analogy with a previous work. The rules of the diagram technique are also formulated for the double spectral functions which determine all the constructions from three pairs of operators: three-particle correlation functions, cross sections of three-quanta processes, nonlinear perceptibilities etc. The unitarity relations are obtained for the double spectral functions. (auth)

33632 PARTON MODEL AND PERTURBATION THEORY. Lipatov, L. N. (Leningrad Inst. of Nuclear Physics). Yadern. Fiz.; 20: No. 1, 181-198(Jul 1974). (In Russian).

It is shown that the calculated structure functions for the ep scattering and the e^+e^- annihilation in the main logarithmic approximation $g^2 \ln(q^2/m^2) \sim 1$, $g^2 \ll 1$, admit a simple interpretation in framework of the parton model with variable cut-off parameter Λ for the transversal momenta, $\Lambda \sim -q^2$. Equations are obtained for the balance of a number of partons in a hadron and a number of hadrons in a parton at variation of Λ. In the framework of the parton approach various relations between the structure functions for the ep-scattering and e^+e^--annihilation channels are discussed. (auth)

33633 BREMSSTRAHLUNG MECHANISM OF e^+e^- AND $\mu^+\mu^-$ PAIR PRODUCTION IN ELECTRON COLLIDING BEAMS. Kuraev, E. A.; Lipatov, L. N. (Inst. of Nuclear Physics, Moscow). Yadern. Fiz.; 20: No. 1, 112-121(Jul 1974). (In Russian).

The spectrum of final particles from e^+e^- and $\mu^+\mu^-$ pair production via bremsstrahlung mechanism is calculated with exponential accuracy in energy. The small and large momentum transfers are considered separately. The total cross sections of e^+e^- and $\mu^+\mu^-$ pair production via bremsstrahlung mechanism are found. (auth)

33634 CALCULATION OF RADIATIONAL CORRECTIONS TO THE SCATTERING AMPLITUDE FOR CHARGED PARTICLES. Shchelkachev, A. V. (Inst. of High Energy Physics, Serpukhov, USSR). Yadern. Fiz.; 20: No. 1, 122-127(Jul 1974). (In Russian).

Taking a relativistic quantum field theory as an example it is shown that to solve the problem of calculation of radiational corrections to the scattering amplitude for charged particles by means of the quasipotential approach one needs at "switching on" the electromagnetic interactions to add not only the Coulomb potential to the pure nuclear potential, but also another electromagnetic potential proportional to α and decreasing as an exponent with the distance. It is also shown that calculating the radiational corrections, due to the photon exchange in the initial and final states, one has to take into account the dependence of the amplitude on the particle masses. (auth)

33635 IS IT POSSIBLE TO OBTAIN INFORMATION ON THE PROTON FORM FACTORS IN THE TIME-LIKE REGION FROM ep ELASTIC SCATTERING EXPERIMENTS. Geshkenbein, B. V.; Ioffe, B. L.; Shifman, M. A. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 20: No. 1, 128-136(Jul 1974). (In Russian).

Possibility is discussed to get an information on the proton form factors in the time-like region from the experimental data obtained in the space-like region. A sum rule is obtained based on the analytical properties of the form factors. It is shown that to get an agreement between the data on the proton form factors in the time-like and space-like regions, assuming a power asymptotics at $|q^2| \to \infty$, $F(q^2) \sim (q^2)^{-n}$, one needs at least four resonances with the photon quantum numbers, $J^P = 1^-$, $T = 0, 1$. The agreement may be obtained also if the asymptotics of the form factors is exponential. (auth)

33636 NEW RIGOROUS APPROACH TO COULOMB SCATTERING. Taylor, J. R. (Imperial Coll. of Science and Tech., London). Nuovo Cim., B; 23B: No. 2, 313-334(11 Oct 1974).

Two properties of nonrelativistic Coulomb scattering are established. The first is that, when considered as a distribution, the Coulomb partial-wave series is convergent (even though divergent as a function) and converges to the Coulomb amplitude. The second property, the proof of which uses the first, is that the amplitude for any screened Coulomb potential converges as a distribution to the Coulomb amplitude (times an overall phase factor) when the screening radius tends to infinity. It is argued that this second property can be made the basis of an economical but rigorous theory of Coulomb scattering. (auth)

33637 ASPECTS OF WEAK AND ELECTROMAGNETIC INTERACTIONS IN THE PRESENCE OF HADRONIC STRUCTURE. Radomski, M. S. Stanford, CA; Stanford Univ. (1974). 212p. University Microfilms Order No. 74-20,229.

Thesis (Ph. D.).

Three calculations are given in which leptonic weak or electromagnetic interactions are used to probe hadronic physics, or vice versa. The first section is an example of use of a strongly-interacting system, with measurable properties, to provide an experimental test of the purely leptonic weak interactions. The second section uses the well-known electromagnetic and weak interactions of leptons to test postulated symmetry properties of the hadronic currents. The third contemplates the use of electrons' electromagnetic properties to examine the dynamics of the rotational motion of deformed nuclei. Differential distributions in lepton triplets (having a neutrino, a lepton, and an anti-lepton) produced from neutrinos through the point four-Fermi interaction and single-photon exchange with a nuclear target were calculated using a Monte Carlo method. The calculations cover energies up to forty billion electron-volts and target nuclei of hydrogen, carbon, iron, and lead. Salient features of the results are that typically the negative lepton is energetic, the positive one much less energetic, and transverse momenta of the charged leptons are quite large (one to two hundred million electron-volts at fifteen billion electron volts beam energy). The theoretical notions of PCAC and current algebra were used for a computation relating the form factors of the nucleon's strangeness-changing axial-vector current to the threshold amplitudes for electroproduction of K mesons and lambda hyperons from proton targets. Measurement of the latter, which requires coincidence techniques, is an increasingly attractive possibility with the continuing improvement of energy-resolution and duty-cycle of electron LINACs. Soft-meson theorems are the basis for the treatment, and corrections necessary for the case of physical kaons are considered in great detail, using a dispersion-relation framework. The corrections are not too small compared to the soft-meson terms, and the uncertainty in their evaluation is large. Existing experimental data (restricted to photoproduction) do not imply stringent limits on the axial vector form factor in question, and future electroproduction results would not be likely to, either, unless they are of unexpected character, or unless treatment is considerably improved upon. The information about nuclear rotational dynamics contained in the transverse multipoles of inelastic electron scattering to discrete states in the ground-state rotational band of even-even deformed nuclei. A formalism for handling multipoles with dynamical dependence on rotation is developed and applied to several models: rigid-body flow model, irrotational flow model, and cranking model. (Diss. Abstr. Int., B)

33638 RADIATIVE PRODUCTION OF NEUTRAL VECTOR MESON IN e^+e^- COLLIDING BEAMS WITH POLARIZATION EFFECTS. Ablakulov, Kh. A.; Gulyamov, U. G.; Kerimov, B. K.; Tsvetkov, V. P. (Inst. of Nuclear Physics, Tashkent). Yadern. Fiz.; 20: No. 2, 407-415(Aug 1974). (In Russian).

The Born approximation is used to calculate the differential and total cross section of a neutral vector meson ($V = \rho^0, \omega, \varphi, \rho'$) and a photon production in the high energy electron-positron annihilation $e^+e^- \to V\gamma$ with longitudinal polarization of ingoing particles, the photon circular polarization and the dipole and quadrupole polarization of V meson. The components of the V-meson quadrupolarization tensor are calculated for arbitrary angle of the V-meson production. The relations between the degrees of the longitudinal $P_V^{(\parallel)}$ and transverse $P_V^{(\perp)}$ polarization of the V meson and the degree of circular polarization of the outgoing photon are calculated. These relations show, in particular, that at V meson forward production $\theta = 0°$ ($\theta = 180°$) the degrees of polarization are the following: $P_V^{(\perp)}$ ($\theta = 0°$) = 0; $P_V^{(\parallel)}$ ($\theta = 0°$) = $-P_\gamma^{(c)}$ ($\theta_\gamma = 180°$) = s_+, where s_+ is the chirality of the ingoing positron ($s_+ = +1$ or -1). It is shown that the V-meson polarization parameters can be determined by measuring the circular polarization degree of the emitted photon. (auth)

33639 ATOMIC RADIATION INDUCED BY FAST PARTICLES. Grigor'ev, V. I.; Muzylev, E. L. (Moscow State Univ.). Sov. Phys. - Dokl. (Engl. Transl.); 18: No. 11, 702-703(May 1974).

Translated from Dokl. Akad. Nauk SSSR; 213: No. 1, 67-69(Nov 1973).

The results of calculations for the probability of radiation of a photon on passage of a fast charged particle close to an isolated hydrogen atom and for the quantity $\hbar\Delta\omega$ determining the average shift of the frequencies in comparison with the spectrum of spontaneous radiation. These results can be of significance as a starting point for considerations of a new spectroscopic method for the detection of charged high energy particles. (JFP)

Weak

Refer also to abstract 34012.

33640 (CERN-74-17) HALO: A COMPUTER PROGRAM TO CALCULATE MUON HALO. Iselin, C. (European Organization for Nuclear Research, Geneva (Switzerland)). 29 Aug 1974. 41p.

HALO is a Monte Carlo computer program which permits the calculation of HALO in muon beams. It may also be used to find the muon background in other charged particle beams. The beam transport system is entered into the program by describing its cross section whenever it changes. Various quantities relevant to the beam behavior, such as, for example, positions, angles, momenta, decay parameters, and many others, may be displayed in the form of one- or two-dimensional histograms. Selected ray histories may be printed out in detail if desired, or saved on disk to be processed later by other programs. (auth)

33641 (ORO-3992-188) GAUGE INDEPENDENCE AND UNITARITY IN THE WEINBERG UNIFIED THEORY. Hsu, J. P.; Sudarshan, E. C. G. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 7p. (CPT-232). Dep. NTIS $4.00.

The Weinberg theory is formulated with the help of the Lagrangian multiplier formalism. A new fictitious Lagrangian is obtained, which differs from the usual one. It is shown by explicit calculation that it restores unitarity and gauge independence of the theory. (auth)

33642 CURRENT TOPICS IN WEAK INTERACTION PHYSICS. Treiman, S. B. (National Accelerator Lab., Batavia, IL). pp 402-431 of Properties of the Fundamental Interactions. Vol. 9, Pt. B. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PB).

The review of weak interactions covers $K_2 \rightarrow \mu^+ + \mu^-$ decay, second class currents, and deep inelastic lepton–hadron scattering. (JFP)

33643 ASYMPTOTIC BEHAVIOR OF AMPLITUDES OF WEAK PROCESSES. Novikov, V. A. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 20: No. 1, 146-148(Jul 1974). (In Russian).

Lower bounds are obtained for total cross sections and amplitudes of weak processes. (auth)

33644 ALTERNATIVE FOCK QUANTIZATION OF NEUTRINOS IN FLAT SPACE–TIME. Unruh, W. G. (California Univ., Berkeley). Proc. Roy. Soc. (London), Ser. A; 338: No. 1615, 517-525(16 Jul 1974).

The neutrino equations in flat space–time are studied in static Rindler accelerated coordinates and in the Penrose conformal coordinates. It is found that the definition of a positive frequency solution to the Dirac equation in the Rindler coordinates is not equivalent to that in Minkowski coordinates, implying inequivalent Fock representations in the two coordinate systems. The definition of positive frequency in the Penrose conformal metric is found to be exactly equivalent to that of Minkowski space–time. A complete set of solutions is found, and the "energy" spectrum is discrete ($\omega = 2n + 1$, $n > j$, where j is the total angular momentum of the eigenfunction) and excludes zero frequency. (auth)

33645 LEPTON BOUND STATES AND GAUGE MODELS. Furlan, P. (Universita Degli Studi, Trieste, Italy). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 43-62(1974).

This paper summarizes work addressed to the following questions: Is it possible that the gauge fields are not elementary but composite? and Is it possible that their constituents are the same fermions to which they couple? It is assumed that the fundamental fields of the physical world are simply two-component spinor fields. The particles that most resemble the quanta of these fields are leptons and, between them, massless neutrinos. The Bethe–Salpeter equation is used to study the possible existence of massless bound states. Gauge invariance and the non-Abelian gauge are considered. Finally, in the section on gauge models, an example of the derivation of a model of the Salam–Weinberg type is given. (RWR)

33646 PARITY-VIOLATING ELECTROMAGNETIC FORM FACTOR OF THE ELECTRON IN THE WEINBERG MODEL. Schuelke, L.; Reid, T. H. (Ruhr-Universitaet, Bochum, Ger.). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 63-65(1974).

Some preliminary results obtained in a calculation of the parity-violating part of electron–electron scattering calculated in fourth order in the Weinberg model are given. Interest is centered on those contributions to electron–electron scattering in which a photon is exchanged; i.e., contributions to the parity-violating electromagnetic form factor of the electron are calculated. In this short paper the results are just summarized. (1 figure) (RWR)

33647 INVERSE $\pi \rightarrow \mu\nu$ DECAY AT INTERACTION OF HIGH ENERGY NEUTRINOS WITH NUCLEONS AND NUCLEI. Berkov, A. V.; Zhizhin, E. D.; Nikitin, Yu. P. (Moscow Engineerin-Physics Inst.). Yadern. Fiz.; 20: No. 2, 422-427(Aug 1974). (In Russian).

The process $\nu_\mu(\bar{\nu}_\mu) + Z \rightarrow \mu^\mp + \pi^\pm + Z$ (as well as the analogous process of $e^\pm$ production induced by the electronic neutrino and antineutrino) in the Coulomb field of nucleons and nuclei at the neutrino energy 3 to 50 GeV is considered. Results are presented of the calculation of the total and differential cross sections with account of the pion structure. Polarization of the produced muons is also found. It is shown that in the production of muons in the neutrino beam there is a cancellation of the contributions to the total cross section from the point-like pion and from the interference term. The result is that the cross section is determined essentially by the structure term in the matrix element. Muons in the process in view have low energies while the pions are emitted with almost total neutrino energy, the fact enabling one, in principle, to separate the process in view on the background of other neutrino reactions. (auth)

33648 NEUTRON ELECTRIC DIPOLE MOMENT AS A TEST OF THE SUPERWEAK INTERACTION THEORY. Wolfenstein, L. (CERN, Geneva). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 141-154(1974).

Theoretical calculations of the neutron electric dipole moment, D_n, are reviewed for various theories of CP violation. It is shown that for the superweak interaction theory D_n is less than 10^{-29} e-cm, in contrast to values of 10^{-23} to 10^{-24} predicted by many but not all milliweak theories. It is concluded that prospective measurements of D_n may provide decisive evidence against or significant evidence in favor of the superweak theory. (1 table) (auth)

Strong (General)

33649 (IC-74/87) ARE LEPTONS REALLY DIFFERENT FROM HADRONS? Salam, A. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1974. 18p. Dep. NTIS $4.00.

A unified model of hadronic and leptonic strong, weak and electromagnetic interactions proposed earlier is discussed in detail. (auth)

33650 (ORO-3992-182) QUANTUM MECHANICS IN PARTICLE PHYSICS. Boehm, A. (Texas Univ., Austin (USA). Center for Particle Theory). [nd]. 15p. (CPT-226). Dep. NTIS $4.00.

The question of whether and to what extent relativistic quantum mechanics can describe the structure of hadrons in principally the same way as nonrelativistic quantum mechanics describes the structure of atoms is considered. This means whether the mass levels of the hadrons and other properties of one-hadron states like decay rates and form factors can be calculated in analogy to energy levels and transition rates for atoms. This problem is discussed using the example of the leptonic and semileptonic decay of the K meson, treating the decay of hadron states in more detail rather than the hadron spectrum. (JFP)

33651 (RL-74-119) DIFFRACTION AND MULTIPARTICLE UNITARITY IN THE DUAL MODEL. Hong-Mo, C. (Science Research Council, Chilton (UK). Rutherford Lab.). Aug 1974. 21p. Dep. NTIS (U. S. Sales Only) $4.25.

An approximate iterative method is proposed for constructing hadronic amplitudes in general, starting from a few assumptions based on phenomenology. A distinctive feature of hadron collisions at high energy is the importance of multiparticle final states. These are all intimately related by unitarity. On the other hand, phenomenology at moderate energies has revealed some striking regularities, in particular: Regge energy dependence, semi-local duality, exchange degeneracy, which seem to reflect the basic structure of hadron dynamics. These empirical observations are combined with multiparticle unitarity in order to arrive at a reasonable model of strong interactions. (UK)

33652 MODEL FOR JET PHENOMENA. Sato, Y. (Waseda Univ., Tokyo). Uchusen Kenkyu; 17: No. 4, 416-420(Feb 1973). (In Japanese).

From symposium on charged particles and cosmic radiation; Hamamatsu, Shizuoka, Japan (Dec 1971).

The purpose of the present paper is to discuss the two-fireball model for jet phenomena. Three assumptions are presented. The first one is that high-energy inelastic scattering can be expressed as $N + N \rightarrow N + N +$ (heavy boson resonance). The second one is that the heavy boson resonance can be described by the statistical bootstrap model of hadrons. In the first-generation decay of the boson resonance, the proportion of two-body decay mode is about

70% and that of three-body decay mode is about 24%. The third assumption is that the heavy boson resonance has high spin, and analogy to nuclear fission can be considered for first-generation decay. It can be said that the pileup of the decays of the first generation and later results in the fireball, and the decay pattern of the heavy boson resonance (0-th generation) corresponds to the number of fireballs and the mode of generation. The bimodal jet corresponds to an event in which the boson resonance decays to two equal masses. A one-cone jet may be an event in which the boson resonance decays to two masses unevenly. The three-hump jet corresponds to the three-body decay of the boson resonance. (JA)

33653 MULTIPLICITY IN HADRON–HADRON INELASTIC REACTIONS AND INELASTIC INTERACTIONS WITH A NUCLEUS. Patashinskii, A. Z. (Nuclear Physics Inst., Novosibirsk, USSR). JETP Lett. (USSR) (Engl. Trans.); 19: No. 10, 338-339(20 May 1974).

Translated from Zh. Eksp. Theor. Fiz., Pis'ma Red.; 19: No. 10, 654-656(20 May 1974).

A connection between the inclusive cross sections in inelastic interactions of fast hadrons with nuclei and the cross sections for interactions with hadrons is obtained within the framework of the parton model. (auth)

33654 POTENTIAL APPROACH TO SPINOR QUARKS. Cho, Y. M. (Univ. of Chicago). Nuovo Cim., 23A: No. 3, 550-556 (1 Oct 1974).

By choosing a special potential for a Dirac spinor, linear fermionic Regge trajectories can be obtained without parity doubling. (auth)

33655 STATISTICAL BOOTSTRAP MODELS FOR BUILD-UP AND DECAY OF ISOSCALAR AND ISOVECTOR FIREBALLS. Engels, J.; Fabricius, K.; Schilling, K. (Univ. of Bielefeld, Ger.). Nuovo Cim., 23A: No. 3, 581-609(1 Oct 1974).

The level density and the decay of isoscalar and isovector fireballs (with input pions) are studied in the framework of the statistical bootstrap model. It is found that different versions of this model lead to the same total multiplicity distribution for large fireball mass M. Asymptotic expressions for the integrated multiplicity correlation of charged particles are derived. The correlations are calculated numerically in the range 1 GeV $\leq$ M $\leq$ 8 GeV. (auth)

33656 COLLECTION OF EVIDENCE FOR TWO COMPONENTS IN MULTIPARTICLE PRODUCTION. Jabs, A. (Trier-Kaiserslautern Univ., Kaiserslautern (F. R. Germany). Fachbereich Physik). Atomkernenergie; 23: No. 3, 216-218(1974).

4 figs.; 18 refs.

Recent data relevant for testing a two-component picture are collected. The data are concerned with 1) large-transverse-momentum cross sections, 2) inclusive single-particle production spectra, 3) the two-particle correlation function f_2, 4) correlation contours in the η_1, η_2 plane and 5) charge distributions. (auth)

33657 MULTIPERIPHERAL THEORY OF HIGH-ENERGY HADRON INTERACTION: COMPARISON WITH EXPERIMENT AT E_L = 70 GeV. Volkov, E. I.; Dremin, I. M.; Dunaevskii, A. M.; Roizen, I. I.; Chernavskii, D. S. (Lebedev Inst. of Physics, Moscow). Yadern. Fiz.; 20: No. 1, 149-164(Jul 1974). (In Russian).

Results predicted by the multiperipheral model based on the Bethe–Salpeter equation are compared with the experiment. The special variant of this model was presented in detail previously. There were 20,000 model events drawn by means of a computer for the pp collision at 70 GeV. Various inclusive, semi-inclusive and two-particle distributions were constructed. The two-particle correlation function is calculated. The obtained distributions are in reasonable agreement with the experiment. (auth)

33658 PRIMAKOFF EFFECT AND THE POLARIZATION EFFECTS IN COHERENT PRODUCTION OF UNSTABLE PARTICLES. Vanzha, A. P.; Lapidus, L. I.; Tarasov, A. V. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 20: No. 2, 416-421(Aug 1974). (In Russian).

Polarization effects due to the interference between the hadron and spin-dependent electromagnetic amplitudes are considered for coherent productions of mesons, hyperons and baryon resonances. The polarization effects of this sort are found to be appreciable in a number of processes where the Pomeranchuk-pole exchange is allowed. (auth)

33659 CORRECTING THE CONCEPT OF DENSENESS FOR THE BOOTSTRAP. Allen, A. D. (Algorithms Inc., Northridge, CA). Int. J. Theor. Phys.; 9: No. 4, 219-224(Apr 1974).

One way of stating the bootstrap theory is to say that hadrons are "dense". In order for this to have a truly physical meaning, and in order for the abstract idea of infinite cardinality to be rigorously self-consistent, it is necessary to redefine the concept of denseness to mean that size is increasing as velocity. (auth)

33660 MASS SPECTRA OF ELEMENTARY PARTICLES AND EXTENDED σ-MODEL. Iwao, S. (Kanazawa Univ., Japan). Progr. Theor. Phys. (Kyoto); 51: No. 4, 1271-1273(Apr 1974).

The σ model is extended to all P_{11} states of the nucleon family, the scalar σ-like bosons, and the family of pions so as to derive mass relations among these particles. To this end a quantum number is introduced which specifies the particle states from low- to high-mass states in succession. The masses ϵ and ϵ' can be predicted, and so-far-unobserved massive pion-like states appear in this approach. (RWR)

33661 BROKEN SU(6) BARYON SPECTRUM. Imachi, M. (Kyushu Univ., Fukuoka); Toyoda, F. Progr. Theor. Phys. (Kyoto); 51: No. 4, 1261-1263(Apr 1974).

It is shown that the SU(6) counting of the urbaryon rearrangement diagram (URD) is connected to the SU(6) spectrum in the s channel. Under the spectator assumption that spectator urbaryons conserve helicity (spin of the SU(6) formalism is interpreted as helicity), a resonance spectrum in s channel is obtained. On the other hand, the H-type URD amplitude can be described directly by the sum of the s-channel SU(6) multiplets {56}, {70}, and {20}. To agree with experiment, the SU(6) scheme must be broken, and a mechanism to do this is introduced. Finally, the Z-type URD amplitude (s–u dual term) is investigated in order to separate it into even- and odd-signature terms; helicity amplitudes are obtained. (1 figure) (RWR)

Strong (Baryon No. = 0)

Refer also to abstract 33563.

33662 (DESY-74/27) FIELD THEORETIC MODEL FOR THE PION FORM FACTOR. P. 1. Formalism. Gutbrod, F.; Weiss, U. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Jun 1974. 39p. INIS.

15 figs.; 26 refs. With abstract.

The formalism of a field theoretic many channel model for the electromagnetic form factors of the $\pi\pi$, the $K\bar{K}$, the $\pi\omega$ and the $\rho-\epsilon$ system is presented. Attractive force, which generates the ρ-meson, is derived from the nucleon box diagram with phenomenological strong vertex corrections. Propagator self energy corrections are derived from the Ward identity. Long range forces are introduced through the pion exchange coupling between $\pi\pi^-$ and $\rho-\epsilon$ channel. The photon is coupled minimally to pions, kaons and nucleons, with subtractions performed at large spacelike momenta. The model is solved in the framework of the Bethe-Salpeter equation. (auth)

33663 (KHFTI-73-10, pp 88-89) COHERENT PHOTOPRODUCTION OF HEAVY NEUTRAL MESONS ON NUCLEI WITH SPIN 0. Adamovich, M. I.; Lebedev, A. I. (Lebedev Inst. of Physics, Moscow). 1973. (In Russian).

The possibility of determining the spin of neutral mesons M^0 during investigation of reactions of their coherent photoproduction on nuclei with spin 0, for example, on ^{4}He ($\gamma + {}^4\text{He} \rightarrow {}^4\text{He} + M^0$) was discussed. The angular distributions of the mesons in the center-of-mass system were determined. (INIS)

33664 PRESENT STATUS OF THE RADIATIVE DECAYS OF MESONS. Morpurgo, G. (Univ., Genoa, Italy). pp 432-477 of Properties of the Fundamental Interactions. Vol. 9, Pt. B. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PB).

The review covers $V \rightarrow P\gamma$ and $P \rightarrow V\gamma$, $P \rightarrow \gamma\gamma$ decays, the question of $V\gamma$ coupling, where P and V are respectively pseudoscalar and vector mesons. Only the lowest nonets are considered. A phenomenological description and attempts of relativistic calculations of vertices in the quark model are discussed. (JFP)

33665 SELECTED TOPICS ON BOSON RESONANCES. Goldhaber, G. (Univ. of California, Berkeley). pp 478-519 of Properties of the Fundamental Interactions. Vol. 9, Pt. B. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PB).

In this review a brief introduction is given, then the new and possible future developments are considered. The $\omega-\rho$ interference pattern, new experimental results, and interfering boson resonance as a tool in strong interactions are covered. (JFP)

33666 INTERFERING RESONANCES AND THE A_2 MASS SPECTRUM. Barnham, K. W. J.; Goldhaber, G. (Univ. of California, Berkeley). pp 520-531 of Properties of the Fundamental Interactions. Vol. 9, Pt. B. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PB).

It is shown that if one abandons the simple dipole formula and considers two interfering resonances, a variation on the alternative solutions considered previously, the A_2^- and A_2^+ spectrum can be reconciled. That is, both mass spectra can be fitted with the same mass and width parameters for the two interfering resonances with only small changes in other parameters. Also it is found that the model gives a good fit to the split A_2^0 and to the A_2^+ spectrum at 3.7 GeV/c reported previously. (JFP)

33667 AMBIGUITY IN $K\pi$ SCATTERING PHASE SHIFT AND K_{l3} FORM FACTORS. Kaneko, T. (Meijo Univ., Nagoya, Japan); Watanabe, K. Progr. Theor. Phys. (Kyoto); 51: No. 2, 633-635 (Feb 1974).

The possibility of selecting a unique solution in the $K + \pi$ scattering phase shift from the K_{l3} form factors is shown. It is shown that the ambiguity in the $I = \frac{1}{2}$ S-wave $K\pi$ scattering can be solved by the information from the K_{l3} form factors. It is emphasized that this is an advantageous point of the $K\pi$ scattering. (JFP)

33668 EXACT S-MATRIX FORMULATION OF OVERLAPPING RESONANCES AND PHENOMENOLOGY OF KAON SYSTEM. Kumar, S. Notre Dame, IN; Univ. of Notre Dame (1974). 74p. University Microfilms Order No. 74-19,534.

Thesis (Ph. D.).

It is shown that a phenomenological S-matrix for two overlapping resonances, namely K_S^0 and K_L^0, can always be written exactly in a form derivable from a potential theory of scattering. The overlap between resonant states and the matrix elements of an effective Hermitian potential are explicitly constructed in terms of the parameters of such a given S-matrix. Further, by using CPT invariance and unitarity condition of this S-matrix which treats K_S^0 and K_L^0 states as overlapping resonances, orthogonal states K^0 and $\bar{K}^0$ are defined such that the Wu-Yang phase convention of CP phenomenology results. The Bell-Steinberger sum rule or unitarity of the above S-matrix is further used to explicitly determine the phase of the mixing parameters of the Wu-Yang phase convention. The phase, thus determined, is then shown to provide a test for various models of CP violation that make statements about the amplitudes $A(K^0 \to \alpha)$ and $A(\bar{K}^0 \to \alpha)$. In particular, the models due to Wolfenstein, Sachs and Truong are examined. Finally, the question of time dependence of the decay amplitudes for overlapping resonances is discussed in light of the recent work due to Kerler and the possibilities of its deviation from the standard exponential form are considered. The decay amplitudes of Kerler are found to be consistent with those used in the given phenomenological S-matrix and whose squares summed over all channels given the full decay widths. (Diss. Abstr. Int., B)

33669 FINITE-WIDTH RESONANCES IN DUAL MODEL. Iroshnikov, G. S.; Chernov, A. S. (Moscow Physical-Technical Inst.). Yadern. Fiz.; 20: No. 1, 165-168(Jul 1974). (In Russian).

For the $\pi^+\pi^-$ scattering as an example a method is presented to describe finite-width resonances in framework of the dual models, preserving the crossing symmetry and other attractive properties of these models. A way to introduce different total widths for $\rho(1^-)$ and $\epsilon(0^+)$ mesons is shown. (auth)

33670 PHOTO AND ELECTROPRODUCTION OF W-MESON. Sherman, V. E. (Leningrad Inst. of Nuclear Physics). Yadern. Fiz.; 20: No. 1, 131-145(Jul 1974). (In Russian).

Expressions for the W-meson photo and electroproduction on a hadron are obtained for the energies much higher than the threshold one at an arbitrary anomalous magnetic moment of the W meson. The validity of Gell-Mann, Dashen, Fubini sum rules is assumed. (auth)

Strong (Baryon No. = 1)

33671 (DESY-74/19) ANALYSIS OF $\pi N \to K\Lambda$ AND $\bar{K}N \to \pi\Lambda$ USING FIXED-T DISPERSION RELATIONS, FESR AND DUALITY. Devenish, R. C. E.; Froggatt, C. D.; Martin, B. R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). May 1974. 39p. INIS.

6 figs.; 6 tabs.; 29 refs. With abstract.

A simultaneous analysis of low-energy ($W \leq 2$ GeV) data for the reactions $\pi^-p \to K^0$ and $K^-p \to \pi^0$ has been made using the hypothesis of two-component duality combined with fixed-t dispersion relations. Results are presented for the $\Sigma^*\pi$ and N^*K couplings. The low-energy amplitudes are used to evaluate FESR integrals and lead to large EXD breaking for the $K^*(V)$-$K^*(T)$ helicity flip amplitudes. (auth)

33672 (DESY-74/24) DUAL QUARKS AND PARTON QUARKS. Kitakado, S. (Deutsches Elektronen-Synchrotron (DESY), Hamburg, (F. R. Germany)). May 1974. 17p. INIS.

13 figs.; 20 refs. With abstract.

The constraints of duality are imposed on the structure functions of total as well as one-particle inclusive deep inelastic electron-nucleon scattering. (auth)

33673 (JINR-E2-8007) CURRENTS AND FORM FACTORS IN LOBACHEVSKY MOMENTUM SPACE AND THE NUCLEON MEAN-SQUARE RADIUS. Skachkov, N. B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 29p. Dep. NTIS (US Sales Only) $4.50.

It is shown, that the invariant definition of the nucleon charge and magnetic mean-square radius can be connected with the nucleon space distribution in an arbitrary reference frame (but not only in the Breit system) if the relativistic coordinate space is introduced with the help of expansions on the Lorentz group. (auth)

33674 (KHFTI-73-10, pp 69-73) INVESTIGATION OF MULTI-BARYON RESONANCES WITH EQUAL AND NONEQUAL TO ZERO STRANGENESS. Shakhbazyan, B. A.; Timonina, A. A. (Joint Inst. for Nuclear Research, Dubna, USSR). 1973. (In Russian).

The interaction between two and more baryons with the following groups was studied: ($\Lambda\Lambda$), (Λp), (Λpp), (K^0p), (pp), (3p), (4p), (5p), and (6p). The experiment was carried out by exposure of the propane chamber (55 cm) to neutrons at momentum of 7.07 GeV/c. On the spectra obtained for the effective mass the group of baryons was distinguished by characteristics which were analyzed for the possibility of the presence of baryon resonance. The candidates for resonance were noted for the systems ($\Lambda\Lambda$) and (Λp), where $M_R = 2370$ and 2252 MeV respectively. (INIS)

33675 (RLO-1388-663) OFF-MASS SHELL PARITY-VIOLATING PION-NUCLEON INTERACTION. II. Applications. Henley, E. M.; Kelliher, T. E.; Pardee, W. J.; Yu, D. U. L. (Washington Univ., Seattle (USA). Dept. of Physics). 1973. 21p. Dep. NTIS $4.25.

Parity-violating effects in the capture reaction $\pi^- + p \to \gamma + n$ for pions at rest and in the elastic scattering of pions from nucleons are suggested as possible tests of the weak off-mass shell pion-nucleon vertex, $G_{\pi NN'}$, proportional to $\cos^2\theta$, where θ is the Cabibbo angle. The on-mass shell vertex proportional to $\cos^2\theta$ vanishes if CP is conserved. Effects of the $\sin^2\theta$ term and of a parity-violating ρ-nucleon coupling are included. The two pion exchange force due to $G_{\pi NN}$ is also investigated. (auth)

33676 SELECTED TOPICS ON BARYON RESONANCES. Barbaro-Galtieri, A. (Univ. of California, Berkeley). pp 532-603 of Properties of the Fundamental Interactions. Vol. 9, Pt. B. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PB).

The review covers resonance formulas: parameters for $\Delta(1236)$, the decay of $\Lambda(1520)$ and $\Lambda(1690)$ into $\Sigma(1385) + \pi$, SU(3) fits, and $\Lambda(1405)$: CDD pole versus bound state. (JFP)

33677 MODEL OF PION-NUCLEON SCATTERING AMPLITUDE AT INTERMEDIATE ENERGIES. Masuda, N. (Louisiana State Univ., Baton Rouge). Progr. Theor. Phys. (Kyoto); 51: No. 1, 313-315(Jan 1974).

A model is proposed in which the difficulty of an inability to predict the whole signature amplitude in the dual absorptive model of vector exchange at intermediate energies is eliminated. The helicity amplitudes at intermediate energies, polarization at 3.5 and 5.0 GeV/c and at higher energies, and the structures of $I = 1$ helicity amplitudes at 6 GeV/c are found for the $\pi^- + p \to \pi^0 + n$ interaction. (JFP)

33678 MAGNITUDE OF THE SIGMA-TERM, CHIRAL SYMMETRY, AND SCALE INVARIANCE. Cabibbo, N. (Univ., Rome). pp 783-803 of Properties of the Fundamental Interactions. Vol. 9, Pt. C. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From Properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PC).

A lecture is given on some previous work on the sigma term in pion-nucleon scattering. Some of the present ideas on the breaking of chiral $SU(3) \times SU(3)$, and the role of the sigma commutator in the testing of specific models of the breaking, and the relations

between the sigma term and π + N scattering are outlined. The actual computations are described. (JFP)

33679 PION-NUCLEON PARTIAL-WAVE ANALYSIS IN THE SECOND RESONANCE REGION AND ITS USE IN PLANNING FUTURE EXPERIMENTS. Shotwell, R. I. Blacksburg, VA; Virginia Polytechnic Inst. and State Univ. (1974). 172p. University Microfilms Order No. 74-20,375.

Thesis (Ph. D.).

Single-energy partial-wave analyses of the pion-nucleon scattering data were performed at five energies in the second resonance region (410, 492, 550, 600, and 692 MeV). Multiple single-energy solutions were found at each energy considered. The single-energy solutions at the two lowest energies were analyzed to determine which experimental observables would best discriminate between the existing solutions. It was found that the measurement of a small number of spin-rotation parameters at carefully selected energies and angles should easily distinguish between the present single-energy solutions. (Diss. Abstr. Int., B)

33680 FORWARD–BACKWARD ASYMMETRY IN MULTIPARTICLE PRODUCTION PROCESSES. Morii, T. (Kobe Univ., Japan); Noda, H. Progr. Theor. Phys. (Kyoto); 51: No. 3, 945-947(Mar 1974).

The connection between the forward–backward asymmetry and the reaction mechanism is investigated; in particular, the way in which the mechanism of switch over from nondiffractive to diffractive reaction mechanism is reflected in the forward–backward asymmetry is studied. The work is illustrated with data from π^-p interactions in the GeV/c range. (2 figures) (RWR)

33681 DIP STRUCTURE AND CROSSING MATRIX ZERO IN VECTOR MESON PRODUCTIONS. Inoue, K.; Kawabe, T.; Uehara, M. (Kyushu Univ., Fukuoka). Progr. Theor. Phys. (Kyoto); 51: No. 2, 528-540(Feb 1974).

Systematics for dip structure of longitudinally polarized vector meson production in the helicity frame is discussed using a weakly exchange-degenerate pion and B-meson Regge-pole model with a slope $\alpha' = 0.7$ GeV^{-2}. While the pion is assumed to transfer only zero helicity in the t-channel, the B-meson is assumed to transfer both zero and one helicity; the ratio of the zero-helicity coupling to the one-helicity coupling turns out to be consistent with the B-meson decay, B → ωπ. Origin of the dip of $\rho^1_{00}d\sigma/dt$ for a ρ production is attributed to the zero of the crossing matrix. It is shown by the same origin that a pion effective trajectory determined by an energy dependence of $\rho^1_{00}d\sigma/dt$ has somewhat discontinuous behavior, which is consistent with the result by Estabrooks and Martin. The original pole is masked for $\rho^1_{00}d\sigma/dt$ by strong absorption for $(\rho^1_{11}-\rho^1_{-1})d\sigma/dt$; the slope of the effective trajectory determined by a t-dependence of $\rho^1_{00}d\sigma/dt$ becomes much steeper than that of the original one. (auth)

Strong (Baryon No. ≥ 2)

Refer also to abstracts 33593 and 33790.

33682 (KHFTI-73-10, pp 54-58) PRODUCT ENERGY DISTRIBUTIONS OF NONMESONIC DECAY OF $_\Lambda He^4$ AND $_\Lambda He^5$ HYPERNUCLEI IN DIFFERENT MODELS. Nikiforov, B. P.; Potashev, A. G.; Filimonov, V. A. 1973. (In Russian).

The energy distributions of protons and neutrons from the nonmeson decay of $_\Lambda He^4$ → dpn and $_\Lambda He^5$ → tpn were calculated in the stimulation model according to which the decay occurs as a result of ΛN → NN process and in the direct transition model Λ → n. A comparison was made of the calculation results obtained and the known experimental data. (INIS)

33683 (ORO-3992-163) EMPIRICAL FRAGMENTATION DISTRIBUTION AND ITS IMPLICATION BASED ON AN INDEPENDENT EMISSION PICTURE. Chiu, C. B.; Ugaz, E. (Texas Univ., Austin (USA). Center for Particle Theory). May 1974. 33p. (CPT-207). Dep. NTIS $4.75.

Multiparticle production in high energy pp collisions was studied from the point of view of a modified independent cluster emission model which as far as this work is concerned can also be viewed as a simple modification of the Chew-Pignotti model. It was found that: the main features of the π^-, K^- and $\bar{p}$ inclusive y-distributions can be described in a unified framework: near the physical boundary the triple-Regge vertex behavior dominates, the empirical fixed-power extrapolation of the triple-Regge formula approximately describes the distribution in the fragmentation region, which then smoothly joins onto the plateau region. A similar behavior of the inclusive distribution in the triple Regge and fragmentation region is also found within the dual resonance model for the hypothetical case of $\pi\pi \to \pi +$ anything. The average multiplicities have in the energy region near threshold the behavior $(\ln s/s_{th})^{1-2\alpha_B} \approx \ln^3 s/s_{th}$, which is directly governed by the empirical extrapolation mentioned above. Assuming absence of correlations between clusters, a reasonable description of σ_T, f_2 and σ_n vs. n is obtained. (auth)

33684 (ORO-3992-165) T-ASYMMETRY IN THE STRONG INTERACTION AT MEDIUM ENERGIES. Bryan, R. A. (Texas Univ., Austin (USA). Center for Particle Theory). 1972. 10p. (CPT-209). Dep. NTIS $4.00.

Current intermediate-energy nucleon–nucleon data sensitive to T-asymmetry are examined and it is concluded that some np polarization (P) and asymmetry (a) measurements constitute the best test of T, even though these data have the largest errors of any of the considered data. The several experiments are related to one another by means of a T-asymmetric one-boson-exchange NN potential model developed by Bryan and Gersten. This model's predictions for the np P–a data exceed experiment by a factor of 4 or so, but it is shown how the model can be easily amended to agree with the data. As such, the modified model still predicts that T-invariance is violated in the strong interaction. On the basis of this model, the accuracy to which new intermediate-energy NN measurements should be made is suggested in order not to miss detecting possible T-asymmetry in the strong interaction. (auth)

33685 INVESTIGATION OF THE THRESHOLD EFFECTS BY A SOLUBLE TWO-CHANNEL MODEL. Its Application to Hyperon–Nucleon Scattering. Beregi, P. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Z. Phys.; 268: No. 4, 365-369 (Jul 1974).

4 figs.; 1 tab.; 14 refs.

Threshold effects are studied by a soluble two-channel model with separable interactions. The optimal conditions for a considerable threshold effect are indicated. The general formalism is applied to the hyperon–nucleon scattering problem investigating the cross sections for coupled N and ΣN channels near ΣN threshold. (auth)

33686 NUCLEON–NUCLEON SCATTERING CALCULATIONS IN A POLE REGULARIZED SPINOR THEORY. Dammeier, K. (Tuebingen Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Z. Naturforsch., A; 29: No. 7, 981-990(Jul 1974).

1 fig.; 15 refs.

A pole regularized nonlinear spinor theory may be a suitable test object to compare scattering calculations of Stumpf's functional quantum theory with LSZ-results. To apply the LSZ-technique in this theory, a dressing of the occurring massless Green's function is necessary. It is shown which special approximations allow for this dressing. The renormalized nucleon–nucleon coupling constant yields the right order of magnitude for the elastic nucleon cross section. (auth)

33687 ELASTIC π^-d SCATTERING AT SMALL MOMENTUM TRANSFERS AND ESTIMATION OF THE CROSS SECTION OF THE QUASIELASTIC πd SCATTERING ON THE ^{6}Li NUCLEUS. Bayukov, Yu. D.; Vorob'ev, L. S.; Leksin, G. A.; Stolin, V. L.; Fedorov, V. B.; Shtern, B. E. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 20: No. 2, 359-361 (Aug 1974). (In Russian).

The cross section $d\sigma_{\pi d}/dt$ of the elastic scattering is calculated at 1.06 GeV/c initial momentum (in the range $-0.11 < t < -0.17$ (GeV/c)^2). It is found that $d\sigma_{\pi d}/dt \propto \exp[(-18 \pm 2)|t|]$. The comparison of the measured cross sections to the cross section of the observed quasielastic πd scattering in ^{6}Li gives the number of the effective deuterons $N_{eff} = 0.7 \pm 0.3$. (auth)

Particle Invariance Principles and Symmetries

General

Refer also to abstract 34094.

33688 (KFKI-74-33) IMPACT PARAMETER AND UNITARY REPRESENTATIONS OF THE SL(2,C) GROUP. Huszar, M. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

Representations of the SL(2,C) group are reduced with respect to the horospheric subgroup $\begin{pmatrix} 1 & \bar{p} \\ 0 & 1 \end{pmatrix}$ isomorphic to the translation group in two dimensions. The matrix elements of unitary representations of the principal and supplementary series are derived in a basis defined by a two-dimensional momentum corresponding to the above subgroup. Matrix elements of unitary representations expressed in this basis assume a simpler form than in any other basis considered so far. The two-dimensional momentum introduced proves to be essentially identical with the impact parameter. (auth)

33689 (ORO-3992-184) COMMENTS ON ALTERNATE FORMS FOR THE BREAKING OF CHIRAL SU(3) × SU(3). Deshpande, N. G.; Dicus, D. A. (Texas Univ., Austin (USA). Center for Particle Theory). [nd]. 18p. (CPT-228). Dep. NTIS $4.00.

Possible alternatives to the usual (3*,3) ⊕ (3,3*) form for the symmetry breaking of chiral SU(3) ⊗ SU(3) are discussed. The width for the decay $X \to \eta\pi\pi$ is calculated in pure (6*, 6) ⊕ (6,6*) breaking model, and result compared with (3*,3) ⊕ (3,3*) and (8,8) models. The symmetry breaking parameters are shown to be restricted to certain allowed regions for both (6*,6) ⊕ (6,6*) and (8,8) representations on the basis of positivity of spectral functions. These restrictions are shown to be particularly severe if the addition assumption $f_K \geq f_\pi$ is imposed. Based on $X \to \eta\pi\pi$ and present $\pi\pi$ scattering data it is concluded that a symmetry breaking which is reducible into (3*,3) ⊕ (3,3*) and (8,8) is favored, and the relative amounts of the two types of breaking are estimated. (auth)

33690 POSITIVITY AND INTERNAL SYMMETRY. Glashow, S. L. (Harvard Univ., Cambridge, MA). pp 805-819 of Properties of the Fundamental Interactions. Vol. 9, Pt. C. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From Properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PC).

Constraints on the cross sections imposed by invariance under an internal symmetry group like isospin of SU(3) are considered. These constraints are equalities and inequalities; only the latter constraints are discussed for meson–baryon interactions. (JFP)

33691 SYMMETRIES OF EXTENDED 3J COEFFICIENTS. D'Adda, A.; D'Auria, R.; Ponzano, G. (Univ. Turin). J. Math. Phys. (N. Y.); 15: No. 9, 1543-1553(Sep 1974).

The symmetries of a function which generalizes the 3j coefficients of SU(2) and of SU(1,1) involving discrete unitary representations are studied. As a by-product of the analysis, the symmetries of the SU(1,1) coefficient are obtained. (auth)

33692 SYMMETRIZED POWERS OF POINT GROUP REPRESENTATIONS. Backhouse, N. B.; Gard, P. (Univ. of Liverpool). J. Phys., A (London); 7: No. 11, 1239-1250(21 Jul 1974).

The problem of decomposing the symmetrized powers of representations of point groups is discussed in detail. Advantage is taken of the fact that each point group representation is closely related either to an induced linear character or to a representation of SU(2). The theory introduced by Gard (J. Phys. A. Math. Nucl. Gen.; 6: 1807-28 and 1829-36 (1973)) is developed to cover the symmetrization of induced linear characters and also representations induced from a normal subgroup. (auth)

33693 EXTERNAL INVERSION, INTERNAL INVERSION, AND REFLECTION INVARIANCE. Pavsic, M. (Institut Jozef Stefan, Ljubljana, Yugoslavia). Int. J. Theor. Phys.; 9: No. 4, 229-244(Apr 1974).

Having in mind that physical systems have different levels of structure the concept of external, internal and total improper Lorentz transformation (space inversion and time reversal) are developed. A particle obtained from the ordinary one by the application of internal space inversion or time reversal is generally a different particle. From this point of view the intrinsic parity of a nuclear particle ("elementary particle") is in fact the external intrinsic parity, if the internal structure of a particle is taken into account. It is shown that non-conservation of the external parity does not necessarily imply non-invariance of nature under space inversion. The conventional theory of beta-decay can be corrected by including the internal degrees of freedom to become invariant under total space inversion, though not under the external one. (auth)

Applications (Electromagnetic and Weak)

Refer also to abstracts 33828, 33829, and 33903.

33694 SOME APPLICATIONS OF CURRENT ALGEBRAS. Radescu, E. E. (Institutul de Fizica Atomica, Bucharest). Stud. Cercet. Fiz.; 25: No. 1, 33-82(1973). (In Rumanian).

This paper is based on the author's doctoral dissertation; he discusses the following topics: current commutators and K_{l3} decays, S-wave pion–nucleon effective range, low-energy weak single-pion production, and chiral symmetry breaking. The first topic is presented in sections on generalized sum rules for K_{l3} decay, evaluation of the sum rules, and dispersion relations in k^2 for $q^2 = \mu^2$. The pion production reaction studied is $\nu_l + N \to N + l + \pi$; kinematics, sum rules, s-wave multipole calculation at threshold, and numerical results and discussion are given. (1 figure, 2 tables) (RWR)

33695 MOLECULAR ASYMMETRY AND WEAK INTERACTION. Hrasko, P.; Garay, A.; Keszthelyi, L. (Central Research Inst. of Physics, Budapest). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 195-197(1974).

Parity is clearly violated in biology as well as in the weak interaction, and it is natural to try to connect the two. Several experiments concerning the interaction of particles with optical isomers are addressed in the paper. One concerns an electron moving through a macroscopically isotropic homogeneous medium which is a pure optical isomer. A simple single-particle model describing this situation is presented. Other consequences of the model are discussed. (RWR)

33696 ESTIMATE OF ENERGY DIFFERENCES BETWEEN OPTICAL ISOMERS CAUSED BY PARITY-NONCONSERVING INTERACTIONS. Rein, D. (Technische Hochschule, Aachen). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 185-193(1974).

Optically active amino acids exist in two forms. Since the L and D forms of an optical isomer are mirror images of each other, their physical and chemical properties should be identical as long as the fundamental interactions are space reflection invariant. Parity-noninvariant interactions, however, can provide for small energy differences between L and D molecules. This paper attempts to give an estimate on the relative magnitude of such parity-violating (pv) effects in molecules. It turns out that pv corrections to molecular binding energies are rather tiny, due to both the small coupling constant and the short range of the weak interaction which violates parity conservation. Differences between mirror molecules due to the parity-nonconserving interaction are discussed. For application in atomic and molecular physics, one must discuss parity-violating eN and ee scattering amplitudes; weak interaction effects and the possibility that the electromagnetic interaction itself violates parity are considered. Finally, it is concluded that possible differences between the binding energies of optical isomers should be expected to be of the order of 10^{-13} eV, too small to be detected at present. (3 figures) (RWR)

33697 ENERGY DIFFERENCE OF MIRROR MOLECULES. Gajzago, E.; Marx, G. (Eotvos Univ., Budapest). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 177-184(1974).

Several gauge theories predict a weak neutral current coupling between leptons and hadrons. This charge-retaining parity-asymmetric weak force is transmitted by the Z^0 boson. If the Hamiltonian of atomic and molecular systems contains a term H', which anticommutes with parity, one may expect parity impurities in atomic spectroscopy and quantum chemistry. Several examples are discussed to show that weak parity impurities may result in a detectable effect in atomic transitions. The essential aim of the report is to explore the consequences of noncommutativity of the molecular Hamiltonian and parity in the chemistry of reflection-asymmetric molecules. The ground-state energies of mirror molecules will not necessarily be equal, and this may be interesting from the biochemical point of view. Diatomic molecules containing different atoms are the simplest examples of asymmetric molecules. Results on MgH are generalized to show that, if only the Coulomb interactions are taken into account in shaping the orbital wave functions, the P-odd, T-even weak perturbation will give no energy difference between mirror molecules in first-order perturbation theory. The situation is different, however, in the case of molecules with paramagnetic properties. Study of this case reveals that mirror molecules showing weak energy differences are expected to be rather complicated. The example of the hydrogen atom shows that H' can lead to a considerable value for a transition matrix element $\langle b|H'|a\rangle$, but it gives only a small energy shift $\langle a|H'|a\rangle$ in molecules (if any at all). The authors conclude by mentioning that it is worth while to consider the possibility that the amazing asymmetries of life are amplified manifestations of the weak symmetry of fundamental forces, but these weak asymmetries may work through a chain of transitions, not in steady states. (RWR)

Applications (Strong)

Refer also to abstract 33661.

33698 (ORO-3992-164) RELEVANCE OF SOME RECENT NEUTRON–PROTON POLARIZATION DATA TO T-VIOLATION AT INTERMEDIATE ENERGIES. Bryan, R. A. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 8p. (CPT-208). Dep. NTIS $4.00.

Some neutron–proton polarization data taken by Leung, Kerth,

and Surko at 520 and 600 MeV are discussed and compared with n–p asymmetry measurements taken by Cheng, MacDonald, Helland, and Ogden at 500 and 600 MeV. The two sets of data agree within experimental error, thus ruling out any T-asymmetry in n–p scattering at intermediate energies greater than a few per cent. The relevance of this to a T-asymmetric nucleon–nucleon potential model developed by Bryan and Gersten is pointed out. (auth)

33699 ALGEBRAIC APPROACH TO THE SATURATION OF CHIRAL $SU_3 \times SU_3$. Buccella, F. (CERN, Geneva). pp 773-781 of Properties of the Fundamental Interactions. Vol. 9, Pt. C. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From Properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PC).

Some given algebraic equations are studied. These are saturated within the set of one-particle states in the $P_z = \infty$ frame. (JFP)

33700 SPONTANEOUS BREAKDOWN OF COMPOUND SYMMETRIES. Cicogna, G. (Univ., Pisa, Italy); de Mottoni, P. J. Math. Phys. (N. Y.); 15: No. 9, 1538-1542(Sep 1974).

The spontaneous breakdown of a symmetry group G which is the direct product of two groups: $G = A \times B$ is considered. The conditions under which the breakdown of G entails that of both A and B are studied. The results are corroborated by an explicit example, where G is $SU_2 \times L$, L being the Lorentz group, and such that any spontaneous breakdown of G entails that of both SU_2 and L. (auth)

Scattering Theory

Refer also to abstract 34096.

33701 (JINR-P2-8211) SCATTERING AT LARGE ANGLES ON THE ANALYTICAL QUASIPOTENTIALS. Goloskokov, S. V.; Kuleshov, S. P.; Matveev, V. A.; Smondyrev, M. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The scattering of high energy particles at large angles is investigated in the framework of the Logunov–Tavkhelidze quasipotential approach. It is shown that the scattering amplitude decreases as a power of s for a broad class of analytical quasipotentials. (auth)

33702 (LBL-759(App.A)) FOUNDATIONS OF S-MATRIX THEORY. Appendix A. The Pragmatic Interpretation of Quantum Theory. Stapp, H. P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 10 Jun 1974. Contract W-7405-eng-48. 14p. Dep. NTIS $4.00.

The pragmatic interpretation of quantum theory is defined. This refinement of the orthodox Copenhagen interpretation covers both the relativistic S-matrix form of quantum theory and also the ordinary nonrelativistic form. The connection of the pragmatic interpretation to the Copenhagen interpretation is described. Contrasts with several other interpretations are drawn. (auth)

33703 (PUC-TN-4/73) LOW ENERGY BEHAVIOR OF THE PHASE SHIFTS FOR VELOCITY-DEPENDENT POTENTIALS. Ferreira, E. M.; Sesma, J. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Instituto de Fisica). 1973. 16p. INIS.

The low energy behavior of the phase shifts originated by a short range velocity-dependent potential is discussed. It is shown that the S wave phase shift goes to zero like the fifth power of the wave number, instead of presenting a linear dependence, as for velocity-nondependent potentials. For other waves, the usual behavior is found. (auth)

33704 RENORMALIZATION AND SYMMETRY: A REVIEW FOR NONSPECIALISTS. Coleman, S. (Harvard Univ., Cambridge, MA). pp 604-623 of Properties of the Fundamental Interactions. Vol. 9, Pt. B. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PB).

The review lecture covers the renormalization of scattering amplitudes and matrix elements of conserved and partially conserved currents. By renormalization is meant the removal of infinities for Feynman amplitudes in perturbation theory for Lagrangian field theories with polynomial interactions. The Bogoliubov method and the Hepp theorem, renormalizable and nonrenormalizable interactions, symmetry and symmetry-breaking: Symanzik's rule, and symmetry and symmetry-breaking: currents are considered. (JFP)

33705 DELBRUECK SCATTERING. Papatzacos, P. Ark. Fys. Seminar Trondheim; No. 5, 1-255(1974).

The amplitude for the scattering of photons by a Coulomb potential (Delbrück scattering) is evaluated to the first nonvanishing order in perturbation theory. Known expressions in the low- and high-energy asymptotic regions are recovered and some numerical results are presented in the form of tables. The numerical results are fitted to experimental data. Reviews of publications about theoretical calculations and experiments, an examination of the connection of Delbrück scattering processes, a derivation of a gauge-invariant expression for the ampiltude and the determination of the singularities of the amplitude and of dispersion relations are also included. (JIW)

33706 INTEGRAL REPRESENTATION FOR ELECTROMAGNETIC FORM FACTORS OF TWO-PARTICLE SYSTEMS. Kirillov, A. I. (Mathematics Inst., Moscow). Teor. Mat. Fiz.; 20: No. 2, 194-201(Aug 1974). (In Russian).

An assumption is accepted about the representation of the connected two-particle matrix element of the current in terms of the boundary values of functions analytic in some small neighborhood of the physical region. Then the integral representation for the form factor of two-particle system is obtained, which expresses the form factor in question in terms of the form factors of the constituent particles and also in terms of the physical S-matrix. No assumptions are made about the dynamics of the two-particle system under study. (auth)

33707 PROPERTIES OF THE UNITARY AND NONUNITARY S-MATRIX ON THE BASIS OF CAUSALITY AND THE COMPLETENESS CONDITIONS FOR WAVE FUNCTIONS. Ol'khovskii, V. S. (Kiev State Univ.). Teor. Mat. Fiz.; 20: No. 2, 211-222(Aug 1974). (In Russian).

General properties of one-channel unitary and nonunitary S-matrix are studied in the case, when the interaction is not known within a sphere of finite radius, while outside of the sphere there is a centrifugal barrier plus nonsingular potential "tail" decreasing asymptotically with the law not weaker than the exponential one. The completeness conditions for the solutions of the Schroedinger equation outside of the sphere with the not known interaction, the symmetry conditions and the generalized unitarity relation for the S-matrix are used. As an illustration the concrete example of resonating behavior of the scattering and absorption cross sections is considered, which generalizes the results known previously in model representation. Besides this, the validity of the orthodox micro- and macro-causality conditions for the final results is investigated. (auth)

33708 BOGOLYUBOV'S R-OPERATION FOR LOCAL INTERACTIONS. Gordevskii, V. D.; Uvarov, O. V.; Chudinovich, I. Yu.; Shcherbina, V. A. (Physical-Technical Inst., Kharkov). Teor. Mat. Fiz.; 20: No. 2, 147-159(Aug 1974). (In Russian).

Parametric representations are constructed for finite parts of the Feynman amplitudes corresponding to the renormalized series of the perturbation theory for the S-matrix. These representations are obtained as limit values of the Feynman amplitudes in spaces with indefinite metrics, so that unitarity and causality of the S-matrix can be verified in all orders of the perturbation theory. (auth)

33709 THREE-BODY LINEAR PROBLEM WITH THREE-BODY INTERACTION. Wolfes, J. (International Center for Theoretical Physics, Trieste, Italy). J. Math. Phys. (N. Y.); 15: No. 9, 1420-1424(Sep 1974).

A three-body potential is introduced for which Schroedinger's equation of the three-body linear problem with additional harmonic and inverse cube forces is solved exactly. (auth)

33710 EXACT SOLUTION OF A ONE-DIMENSIONAL THREE-BODY SCATTERING PROBLEM WITH TWO-BODY AND/OR THREE-BODY INVERSE-SQUARE POTENTIALS. Calogero, F.; Marchioro, C. (Univ., Rome). J. Math. Phys. (N. Y.); 15: No. 9, 1425-1430(Sep 1974).

The exact solution is presented of the scattering problem of three equal particles interacting in one-dimension via two- and/or three-body inverse-square potentials. Both the classical and the quantal problems are treated. It is shown that the outcome of this scattering problem is an extremely simple relation between initial and final momenta, the latter being univocally determined by the former even in the quantal case. The solvability of the problem, and the simple results just mentioned, are peculiar to the equal particle case. (auth)

33711 EXISTENCE AND UNIQUENESS OF SOLUTIONS OF LOW'S PROBLEM. Nedelkov, I. P. (Inst. of Physics, Sofia). J. Math. Phys. (N. Y.); 15: No. 9, 1508-1515(Sep 1974).

In the framework of S-matrix theory, the partial scattering amplitudes are sought as a solution of a certain problem involving analyticity, unitarity, and crossing symmetry. This problem, with a condition of analyticity which is weaker than the usual one, is called Low's problem. By means of the fixed-point theorems of Schauder and Banach-Cacciopoli, conditions for the existence and uniqueness of solutions to Low's problem are given. (auth)

33712 ELIMINATION OF A COORDINATE SINGULARITY IN THE THREE-BODY PROBLEM. Hill, R. N. (Univ. of Delaware, Newark). J. Math. Phys. (N. Y.); 15: No. 9, 1596-1598 (Sep 1974).

One of the coordinate systems commonly used in the three-body problem consists of three center-of-mass coordinates, three interparticle separations, and three Euler angles specifying the orientation of the triangle whose vertices are the three particles. The usual specification of the Euler angles for this system, which aligns the axes of the body-fixed coordinate system with the principal axes of the moment of inertia tensor, results in a coordinate singularity whenever two of the moments of inertia are equal. An alternative specification of the Euler angles for the equal mass case which treats the three particles symmetrically and eliminates the coordinate singularity at the equilateral triangle configuration is presented. (auth)

33713 SPECTRAL REPRESENTATION OF THE PENTAGON DIAGRAM AMPLITUDE. Frederiksen, J. S. (Univ. of Groningen, Netherlands). J. Math. Phys. (N. Y.); 15: No. 9, 1443-1450 (Sep 1974).

A method developed previously is used to derive a double spectral representation with Mandelstam boundary for the pentagon diagram amplitude for the production process AB → CDN. Restrictions on the masses and kinematic invariants for which this representation is valid are found, and it is discussed how a representation can be obtained for wider ranges of these variables. Finally, a comparison is made with the results of others. (auth)

33714 SOME UNITARITY BOUNDS FOR FINITE MATRICES. Mennessier, G.; Nuyts, J. (Laboratoire de Physique Theorique et Hautes Energies, Orsay, France). J. Math. Phys. (N. Y.); 15: No. 9, 1525-1537(Sep 1974).

The problem of obtaining the bounds on the modulus of one element of a finite unitary matrix once the values of the moduli of a set of other elements are given is studied. The problem is solved in simple cases, and indications of more general cases are given. This question is interesting from a physical point of view since it leads to direct inequalities between sets of partial waves. It would also be useful to extend this kind of results to the continuous matrices where inequalities on cross sections could be obtained. (auth)

33715 DERIVATION OF THE DISPERSION RELATION WITH THE INFINITE-MOMENTUM LIMIT APPROACH. Tataru-Mihai, P. I. (Univ., Cluj). Stud. Cercet. Fiz.; 26: No. 3, 275-282(1973). (In Rumanian).

The infinite momentum limit approach is used to show that the scattering amplitude for scalar spinless particles obeys a twice subtracted dispersion relation. It is pointed out that these subtractions arise from the same terms which play a fundamental role in the dispersion theory of low energy limit, i.e. the high energy behavior of the scattering amplitude is in part conditioned by the information on the low energy behavior. (auth)

PHYSICS (LOW-TEMPERATURE)

33716 ^{151}Eu LOW TEMPERATURE MOESSBAUER THERMOMETER. Shenoy, G. K. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Lab. de Chimie Nucleaire); Maletta, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Festkoerperforschung). Z. Phys.; 269: No. 3, 241-244(1974).

3 figs.; 7 refs.

A Moessbauer thermometer suitable for the 25 to 250 mK temperature range with ^{151}Eu in EuS as the absorber is discussed, and the problems of absorber thickness are pointed out. The large correction for the apparent temperature deduced from the sum of Lorentzian analysis is given for absorbers with a different number of resonance nuclei per cm^2. With the correction procedure, without a least-square fit using the transmission integral, one can obtain the temperature with an accuracy of better than ±2%. (auth)

Superfluidity

33717 THEORY OF EVAPORATION FROM SUPERFLUID ^{4}He. Salinas, S. R. (Univ., Sao Paulo, Brazil); Turski, L. A. Acta Phys. Pol.; A46: No. 3, 331-339(Sep 1974).

The revised theory of evaporation from superfluid helium based on the Bogoliubov model of interacting many-boson systems is presented. In contrast to previous theoretical calculations no sizable shift towards higher energies of the energy distribution function for evaporated atoms is obtained. Our results are in much better agreement with the revised version of the original King and Johnston experiment which indicated no shift in the energy of the evaporated atoms. Using our model it is possible to trace the assumptions that have led in the previous theories to the prediction of a shift. (auth)

33718 ABSORPTION OF FIRST SOUND IN CONCENTRATED SUPERFLUID ^{3}He–^{4}He SOLUTIONS. Dyumin, N. E.; Esel'son, B. N.; Rudavskii, E. Ya. (Physical-Technical Inst. of Low Temperatures, Kharkov). Zh. Eksp. Teor. Fiz.; 67: No. 2, 696-705 (Aug 1974). (In Russian).

The temperature, frequency and concentration dependences of the absorption coefficient of first sound in superfluid ^{3}He–^{4}He solutions containing from 6.3 to 31.4% ^{3}He are investigated at sound frequencies of 5.00, 9.65 and 15.00 MHz in the 0.4 to 1.6°K temperature range. It is shown that with increase of ^{3}He concentration the contribution of second viscosity to the absorption decreases and the role of first viscosity and diffusion is predominant. The quadratic dependence of the absorption coefficient on frequency is found to be invalid at low temperatures. (auth)

33719 SOME PROBLEMS REGARDING THE HYDRODYNAMICS OF SOLUTIONS OF TWO SUPERFLUID LIQUIDS. Mineev, V. P. (Inst. of Solid State Physics, Moscow). Zh. Eksp. Teor. Fiz., 67: No. 2, 683-690(Aug 1974). (In Russian).

Propagation of fourth sound in solutions of two superfluid liquids is investigated on basis of the hydrodynamic equations for such solutions. The existence of two fourth sounds is demonstrated. The possibility of exciting fourth sounds by wall oscillations in a direction perpendicular to the plane of the wave is studied. Hydrodynamic equations for solutions of two superfluid liquids with dissipative terms are derived. The equations contain ten independent kinetic coefficients: one for first viscosity, six for second viscosity and one for diffusion, thermodiffusion and thermal conductivity each. (auth)

33720 VORTEX RING GENERATED LEVEL DIFFERENCES IN SUPERFLUID HELIUM. Carey, R. F. Cleveland; Case Western Reserve Univ. (1974). 77p. University Microfilms Order No. 74-16,479.

Thesis (Ph. D.).

Level differences between two baths of liquid helium connected by an orifice are generated by a charged vortex ring beam incident on the diaphragm containing the orifice. The data are interpreted in terms of phase slippage caused by vortex rings which overlap the orifice. Deviation of the data from expected results is examined in light of vortex ring interactions and beam spreading. (Diss. Abstr. Int., B)

33721 SECOND-SOUND VELOCITY AND SUPERFLUID DENSITY IN ^{3}He–^{4}He MIXTURES NEAR SUPERFLUID TRANSITION POINTS: APPLICABILITY OF UNIVERSALITY AND SCALING LAWS. Terui, G.; Ikushima, A. (Tokyo Univ.). J. Low Temp. Phys.; 16: No. 3-4, 291-303(Aug 1974).

From second-sound velocity measurements, superfluid densities near superfluid transition points were determined in ^{3}He–^{4}He mixtures under saturated vapor pressure. The critical exponent of the superfluid density thus obtained increases about 15% with increasing ^{3}He concentration up to 40 mole percent, which contradicts the universality concept. Furthermore, the critical exponents obtained here and the exponents of the specific heat do not satisfy the scaling laws. A new concept of universality is introduced and discussed. (auth)

33722 GRAVITATIONAL FLOW OF SUPERFLUID HELIUM THROUGH SMALL ORIFICES. Banton, M. E. (Yale Univ., New Haven). J. Low Temp. Phys.; 16: No. 3-4, 211-228(Aug 1974).

Data are presented on the flow of superfluid helium through channels of diameters 2.5 and 5.0 μm. Three modes of flow are observed: (1) flow that can be identified with the thermal nucleation of vorticity, (2) flow described by $\Delta z \propto (t - t_0)$, where Δz is the gravitational head and t the time, and (3) flow described by $(\Delta z)^{1/2} \propto (t - t_0)$. Associated with the third mode, flows appear with a critical velocity close to that of the Feynman prediction for small channels. (auth)

33723 LOW TEMPERATURE INDIUM SEALS. Agarwal, K. L.; Betterton, J. O. (Univ. of New Orleans). Cryogenics; 14: No. 9, 520(Sep 1974).

A method is described, using 1.6 mm dia indium wire or a 0.44 mm thick gasket cut from indium foil and brass screws, to make a seal for low temperature calorimeter work, between flat mating copper surfaces. It is thought that the success of the method lies in the following: (1) Using brass screws, since brass has a larger coefficient of thermal expansion than copper so the screws keep on tightening as the temperature is lowered. (2) Using twelve screws instead of six or eight to exert more and uniform pressure all around the seal. (3) Careful cleaning of the mating surfaces to ensure better bonding of indium to copper. (UK)

33724 CONSTRUCTION OF PLATINUM LEAD-GLASS SEALS FOR LIQUID HELIUM TEMPERATURES. Agarwal, K. L.; Betterton, J. O. (Univ. of New Orleans). Cryogenics; 14: No. 9, 519-520(Sep 1974).

Experience in constructing platinum lead-glass seals for leading electrical wires out of the sample chamber in low temperature work is described. Thin platinum tube (1.0 cm o.d. and 0.012 cm wall thickness), platinum wire 0.025 cm dia, small pieces of crushed lead-glass and high purity graphite mould were used. The seals made as described are reliable, leaktight in HeII and perform many times before failure. (UK)

33725 VELOCITY AND PHASE OPERATORS FOR MANY-BOSON SYSTEMS. Nishiyama, T. (Osaka Univ., Toyonaka, Japan). Progr. Theor. Phys. (Kyoto); 51: No. 4, 1264-1266 (Apr 1974).

Ever since the appearance of London's theory of superfluidity, the existence of the velocity operator in quantum mechanics has been a problem. It is shown here that the velocity operator can be defined by using a Hermitian phase operator ϕ^S, the so-called sine phase difference operator due to Susskind and Glogower [Physics, 1, 49 (1964)], by defining the operators in a lattice space and taking the continuum limit. The velocity vector given in this way becomes irrotational, except at a singular point of zero density. At such a singular point, the different vector components of the velocity are not commutative with each other. Neither the canonical conjugate variable of the density nor the inverse of the density is needed in this approach. (RWR)

Superconductivity

Refer also to abstracts 32751, 32756, and 32761.

33726 (AD-777743) PRELIMINARY REPORTS, MEMORANDA, AND TECHNICAL NOTES OF THE MATERIALS RESEARCH COUNCIL SUMMER CONFERENCE HELD AT LA JOLLA, CALIFORNIA, JULY 1973. Volume 1. Hucke, E. E. (Michigan Univ., Ann Arbor (USA)). Jul 1973. Contract DAHC15-71-C-0253. 679p. NTIS $11.00.

Complete papers and reports of work in progress which represent initial ideas, problem suggestions, position papers, and status reports are presented. (auth)

33727 (AD-778041) FLUX QUANTIZATION AND THE JOSEPHSON EFFECT IN EXTREME TYPE II SUPERCONDUCTORS.

Annual Summary Report, 1 April–31 December 1973. Janocko, M. A.; Jones, C. K. (Westinghouse Research Labs., Pittsburgh, Pa. (USA)). 1 May 1974. Contract N00014-73-C-0315. 10p. NTIS $3.00.

Most of the work performed was concerned with fabrication of junctions of very high T(C) materials. Several Nb_3Ge junctions were examined, with inconclusive results. Further work on Mo–Re junctions has increased the temperature range of operation. Single junction magnetometer loops were fabricated for testing at NRL. (GRA)

33728 (AED-CONF-73-121-003) VALIDITY OF BRAGG'S RULE IN SPUTTERED SUPERCONDUCTING NbN AND NbC FILM OF VARIOUS COMPOSITIONS. Meyer, O.; Linker, G.; Kraeft, B. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Kernphysik). 1973. 12p. (CONF-730485-1).

From meeting on hard materials; Lindau, F. R. Germany (5 Apr 1973).

Niobium nitride layers have been produced by reactive sputtering in an argon-nitrogen plasma. Changes in composition have been determined by measuring the niobium peak height at the layer surface in backscattered spectra, as well as by measuring the superconducting transition temperature T_c in homogeneous layers. The results are compared with niobium peak heights, calculated as a function of the number of nitrogen to niobium atoms ratio, using experimental and theoretical stopping cross sections for $^4He^+$ ions for niobium and nitrogen. Assuming the validity of Bragg's rule, the measured values are found to be 7 to 8% smaller than those calculated. During the production of NbC-layers in an Ar-plasma the Nb-target has been covered by a perforated C-plate. Stoichiometric layers have been produced with T_c-values similar to that for bulk samples. The deviation between calculated and measured Nb peak heights is in the same order magnitude as that found for NbN. (GE)

33729 (BMFT-FB-T-73-11) INVESTIGATIONS ON THE CRITICAL CURRENT DENSITY OF VAPOR-DEPOSITED Nb_3Sn. Wohlleben, K. (Bundesministerium fuer Forschung und Technologie, Bonn (F. R. Germany); Zentralstelle fuer Luft- und Raumfahrtdokumentation und -Information, Muenchen (F. R. Germany)). Jul 1973. 32p. (In German).

The addition of carbon during the deposition of Nb_3Sn from the vapor phase (deuteron activation analysis) results in a considerable increase of the critical current density. This reaches a maximum of approximately 1.0×10^6 A/cm² at 50°C with about 3 at. % carbon. When irradiated with 2 MeV protons the critical current density of a non-optimally C-doped layer increases further while that of an optimally doped layer decreases. Annealing for a short period at 600 to 800°C always leads to an increase by an average of 60%, irrespective of the initial value. The pinning centers produced by C-doping and by irradiation are superposed. (GE)

33730 (COM-74-50460) PROPERTIES OF SELECTED SUPERCONDUCTIVE MATERIALS. 1974 Supplement. Roberts, B. W. (General Electric Co., Schenectady, N. Y. (USA)). Apr 1974. Contract C-3-35717. 89p. (NBS-TN-825). NTIS.

Data on additional superconductive materials extracted from a portion of the world literature up to mid-1973 is given. The data presented are new values and have not been selected or compared to values (except for selected values of the elements) previously assembled by the superconductive materials data center. The properties included are composition, critical temperature, critical magnetic field, crystal structure and the results of negative experiments. Special tabulations of high magnetic field materials with Type-II behavior and materials with organic components are included. All entries are keyed to the literature and a list of reviews centered on superconductive materials is included. (auth)

33731 (PTB-W-1) MODIFICATION OF THE ELIASHBERG-FUNCTION AND VARIATION OF THE TRANSITION TEMPERATURE BY STRONG LATTICE DISTORTIONS IN SUPERCONDUCTING NON-TRANSITION METAL-FILMS AFTER CHILLED CONDENSATION. P. I. Kessel, W. (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany). Abt. Waerme). Jan 1973. 94p. (In German).

The influence of strong lattice distortions of quench-condensed metal films on the transition temperature of a non-transition metal superconductor is explained. (GE)

33732 (PTB-W-2) MODIFICATION OF THE ELIASHBERG-FUNCTION AND VARIATION OF THE TRANSITION TEMPERATURE BY STRONG LATTICE DISTORTIONS IN SUPERCONDUCTING NON-TRANSITION METAL-FILMS AFTER CHILLED CONDENSATION. P. II. Kessel, W. (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany). Abt. Waerme). Jan. 1973. 47p. (In German).

The influence of strong lattice distortions of quench-condensed metal films on the transition temperature of a non-transition metal superconductor is explained. (GE)

33733 EFFECT OF NEUTRON IRRADIATION DAMAGE ON THE MAGNETIC BEHAVIOR OF SUPERCONDUCTING NIOBIUM IN STATIONARY FIELDS. van der Klein, C. A. M.; Kes, P. H.; van Beelen, H.; de Klerk, D. (Kamerlingh Onnes Laboratorium, Leiden). J. Low Temp. Phys.; 16: No. 1/2, 169-191 (Jul 1974).

The effect of irradiation with fast neutrons (at reactor ambient temperatures up to doses of 1.5×10^{20} n/cm²) on the magnetic behavior in stationary fields of superconducting niobium samples has been studied. Surface effects have been removed by oxidation of the samples. Irradiation leads to an increase of H_{c2}, which disappears after annealing the samples at 400°C. Also, the irreversibility of the magnetization increases and a peak effect is induced in the magnetization curves. These effects, due to an increased bulk pinning, are rather small, except in the samples irradiated with the highest dose. Electron microscope pictures showed that this is due to the fact that only for the highest dose do the clusters of interstitials which are introduced in the sample by the irradiation form extended defects, with sizes larger than the coherence length ξ. A discussion is given of the surface barrier before and after irradiation, of the H_{c2} shift due to the irradiation, and of the increased irreversibility of the magnetization. It turns out that near H_{c2} the irradiation damage has to be treated as line defects, rather than as point defects, whereas at lower fields neither the critical state formula of Labusch for point pinning nor that of Good and Kramer for line pinning describes the experimental results exactly, although the differences do not seem to be very dramatic. It is concluded that in the lower field region a combination of point and line pinning occurs. The peak effect has been discussed in a foregoing paper. (auth)

33734 ELECTRON INHIBITION OF DISLOCATIONS IN SUPERCONDUCTORS WITH OVERLAPPING ENERGY ZONES. Druinskii, E. I. (Physico-Technical Inst., Kazan). Fiz. Metal. Metalloved.; 37: No. 1, 207-208(Jan 1974). (In Russian).

Expressions based on a one-zone theory for the electron inhibition of dislocations are modified to account for the multi-zone nature of the surface of metals, which comprise the majority of superconductors. (MG)

33735 SUPERCONDUCTIVITY AND ELECTRON STRUCTURE OF VERY-HIGH-PURITY NIOBIUM. II. Superconductivity Properties of Very-High-Purity Niobium. Alekseevskii, N. E.; Nizhankovskii, V. I.; Bertel, K. Kh. (Inst. of Problems in Physics, Moscow). Fiz. Metal. Metalloved.; 37: No. 1, 63-75(Jan 1974). (In Russian).

Measurements of critical magnetic fields, curves of magnetism, and critical currents of niobium samples of different purities are reported. Very-high-purity niobium close to T_c was shown to be a superconductor of the first type and to become a superconductor of the second type with a decrease in temperature because of the temperature dependence of the Ginsburg–Landau parameters. The dependence of hysteresis of the magnetism curves of the mass samples on the surface state was studied. The superconductivity parameters of niobium were compared with the electron spectrum parameters. The dependence of the critical current of niobium wires on a longitudinal magnetic field was consistent with the theory of a weak distribution of current. (tr-auth)

33736 DEPENDENCE OF CRITICAL TEMPERATURE OF SUPERCONDUCTORS ON SHAPE OF PHONON SPECTRUM. Medvedev, M. V.; Pyatiletov, Yu. S. (Inst. of Metal Physics, Moscow). Fiz. Metal. Metalloved.; 37: No. 2, 244-256(Feb 1974). (In Russian).

The solution of the Eliashberg temperature equation for superconductors in the case of strong connections were solved by approximation of the anomalous intrinsic energy part of the Morel–Anderson test model, and a formula was found for the critical temperature (without consideration of the electron damping effect). Because of the two Einstein frequencies, the dependence of the critical temperature on the location of the low-frequency peak was studied in the phonon spectrum model. It was shown that the appearance of such a peak in the low-frequency region begins to weaken the superconductivity. The use of the Morel–Anderson function and the step-wise test function and precision of the model approximating the renormalizing factor in the case

of strong bonds gives a lower calculated value of the critical temperature. (tr-auth)

33737 MAGNETIC FIELD OF PURE SUPERCONDUCTORS WITH NON-ISOLATED FLUX LINES AT ARBITRARY TEMPERATURES. Brandt, E. H. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Phys. Status Solidi (b); 64: No. 2, 467-478 (1 Aug 1974).

The magnetic field distribution of pure type-II superconductors with small magnetization is derived from the nonlocal version of Gorkov's theory. At zero temperature Delrieu's result is reproduced; at the vortex centre the field shows a cusp and exceeds the external field. The form factors have alternating sign and decrease only as K^{-3}. At larger magnetization all form factors become positive. At T = 0, even close to H_{c2}, a gap function is expected deviating considerably from the H_{c2}-solution. This means a pronounced narrowing of the vortex core at low temperatures. (auth)

33738 FLUX CREEP DYNAMICS OF THE QUASI-ELASTICALLY BOUND VORTICES IN TYPE II SUPERCONDUCTORS. Kirschner, I. (Roland Eoetvoes Univ., Budapest). Acta Chim. Acad. Sci. Hung.; 36: No. 2, 149-153(1974).

A model of the flux creep state has been constructed on the base of a force proportional to the vortex movement. Non-equilibrium vortex density is induced by the effect of external electric current introduced into type-II superconductors. Its equalization is an exponentially time dependent process. This generates a state of dynamic flux creep studied in this paper. (auth)

33739 INFRARED CONDUCTIVITY OF TETRATHIOFULVALENE TETRACYANOQUINODIMETHANE (TTF-TCNQ) FILMS. Tanner, D. B.; Jacobsen, C. S.; Garito, A. F.; Heeger, A. J. (Univ. of Pennsylvania, Philadelphia). Phys. Rev. Lett.; 32: No. 23, 1301-1305(10 Jun 1974).

Infrared studies of thin films of TTF-TCNQ were analyzed to obtain the frequency-dependent conductivity. In the metallic state the results indicate an energy gap (0.14 eV) with a collective mode at zero frequency. Below 58°K the conductivity peak moves away from zero frequency into the far infrared. (auth)

33740 SUPERCONDUCTIVITY OF AMORPHOUS VANADIUM. Kuz'menko, V. M.; Lazarev, B. G.; Mel'nikov, V. I.; Sudovtsov, A. I. (Physical-Technical Inst., Kiev). Zh. Eksp. Teor. Fiz.; 67: No. 2, 801-807(Aug 1974). (In Russian).

The superconducting properties of amorphous vanadium films, obtained by low-temperature condensation, are investigated for the first time. In contrast to other amorphous metals, the superconductivity temperature (T_c) for amorphous vanadium is much lower than that for the stable crystalline phase. The critical magnetic field $H_c \approx (2-3) \cdot 10^4 T_c$ in the 300 to 50 Å thickness range. (auth)

33741 EFFECT OF MAGNETIC FIELD ON FLUCTUATION CONDUCTIVITY OF LAMELLAR SUPERCONDUCTORS. Golub, A. A. (Inst. of Applied Physics, Kishinev, USSR). Zh. Eksp. Teor. Fiz.; 67: No. 2, 706-711(Aug 1974). (In Russian).

The effect is studied of a stationary magnetic field on fluctuation conductivity of pure lamellar superconductors with Josephson interaction between the layers. The fluctuation correction to the conductivity is calculated by taking into account the paramagnetic effect. It is shown that the latter may lead to a great increase of the role of superconducting fluctuations. The role of the paramagnetic effect is great if the critical temperature $T_c(H)$ is determined by means of excited Landau orbits. (auth)

33742 FLUCTUATION MAGNETIC SUSCEPTIBILITY OF SUPERCONDUCTORS AND NORMAL METALS. Aslamazov, L. G.; Larkin, A. I. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 2, 647-660(Aug 1974). (In Russian).

It is shown that the fluctuation diamagnetic susceptibility of superconductors above the transition temperature slowly decreases with increase of temperature, in accordance with a logarithmic law. In normal metals interaction between electrons also leads to a temperature dependence of the magnetic susceptibility. The case of an anisotropic metal is investigated. The fluctuation effect is greater in layered metals and the fluctuation magnetic susceptibility may appreciably exceed the Landau diamagnetism. Layered normal metals, in particular, should exhibit strong electron paramagnetism. In quasi-one-dimensional systems the fluctuation magnetic susceptibility is of the same order of magnitude as that of an isotropic metal. Allowance for impurities weakens the susceptibility temperature dependence at temperatures below the inverse electron mean free time. (auth)

33743 THERMAL CONDUCTANCE OF LAYER STRUCTURE DICHALCOGENIDES. Sichel, E. K. (Rutgers-The State Univ., New Brunswick, NJ); Serin, B.; Revelli, J. F. J. Low Temp. Phys.; 16: No. 3-4, 229-235(Aug 1974).

The thermal conductance was measured in the temperature range 0.5 to 7°K of the layer structure compounds $TaS_{1.6}Se_{0.4}$ and $TaS_{1.6}Se_{0.4}$ (pyridine)$_{\frac{1}{4}}$ parallel to the plane of the layers in both the normal and superconducting states. Our results indicate that the phonon contribution to the thermal conductivity, which varies approximately as $T^{1.6}$ at low temperatures, dominates the electronic contribution in both the normal and superconducting phases. (auth)

33744 ELECTRON FOCUSING AND FERMI SURFACE DIAMETER. Goncalves da Silva, C. E. T. (Univ. of California, Berkeley). J. Low Temp. Phys.; 16: No. 3-4, 337-348(Aug 1974).

A simple model calculation of the effects of electron focusing on the transport properties of a semiinfinite metallic slab in the presence of a magnetic field was performed. In particular, the case in which current is fed into the slab through two superconducting strips, with the field applied parallel to the strips, is considered. A thin resistive layer is assumed to exist on the surface of the metal. The cases of short and long mean free paths compared with the separation of the leads are treated. For the latter case an integral equation is derived relating the normally flowing current to the potential at the surface. This equation is used to study the magnetoresistance for three models of the Fermi surface: a free-electron-like surface, a compensated free-electron, free-hole-like surface, and a compensated surface composed of three free-electron-like sheets and one free-hole-like sheet. This latter model is topologically equivalent to the Bi case. The results of the calculation agree qualitatively with the experimental results for fields of the order of and larger than the focusing field. (auth)

33745 PROPERTIES OF THE FLUX LINE LATTICE IN HYSTERETIC TYPE II SUPERCONDUCTORS. I. Neutron Diffraction Experiments. Weber, H. W.; Schelten, J.; Lippmann, G. (Kernforschungsanlage, Juelich, Ger.). J. Low Temp. Phys.; 16: No. 3-4, 367-379(Aug 1974).

A detailed study of neutron rocking curves on flux line lattices was made in single-crystalline hysteretic type II superconductors with Ginzburg-Landau parameters between 1.0 and 2.5. Information was obtained about the symmetry and the quality of the flux line lattice as a function of crystal orientation, sample purity, and magnetic field. The flux line lattice is always observed to form a single crystal. The width of the rocking curves, which is a measure of the misorientation of flux line crystallites in the plane perpendicular to the external field, is found to decrease strongly with increasing field along the initial magnetization curve, and to be much smaller upon decreasing the field from above H_{c2}. This width varied between 8 and 1.5°. The minimum size of a coherently scattering flux line crystallite was estimated to be about 2 to 3 μm. Along the initial magnetization near H_{c1} the flux is found to form flux line bundles of constant lattice spacing. Although large flux density gradients have been observed earlier with field probes near H_{c1}, the lattice parameter measured with neutrons remained constant in this field range. (auth)

33746 FLUCTUATION-INDUCED CONDUCTIVITY IN LAYERED SUPERCONDUCTORS. Klemm, R. A. (Harvard Univ., Cambridge, MA). J. Low Temp. Phys.; 16: No. 3-4, 381-385 (Aug 1974).

The method of Mikeska and Schmidt is employed to calculate the fluctuation-induced conductivity for dirty, layered superconductors with the magnetic field perpendicular to the layers. The frequency dependence of the ac conductivity is found for small frequencies, and a new parameter is introduced which distinguishes between regions of different apparent dimensionality. (auth)

33747 SUPERCONDUCTING NUCLEATION FIELDS AND PROXIMITY EFFECT OF NORMAL-SUPERCONDUCTING-NORMAL TRIPLE LAYERS. Fink, H. J. (Univ. of California, Davis). J. Low Temp. Phys.; 16: No. 3-4, 387-397(Aug 1974).

Superconducting nucleation fields for normal/superconducting/normal (nsn) triple layers are calculated when the static field is applied parallel to the ns boundaries, the s layer is of arbitrary thickness, and the n metals are identical and very thick. Comparing these results with experiments by Jain and Tilley on Cu/Pb/Cu triple layers, one finds that Zaitsev's microscopic ns boundary conditions apply (at least approximately) over a wide range of temperatures at the nucleation field. This implies that $p_F\Delta_G$ is continuous across a ns boundary for diffuse and Δ_G for specular electron scattering (Δ_G is the Gor'kov pair potential, p_F the Fermi momentum). Furthermore, the magnitudes of the order parameters on the ns boundary are similar for Cu and Pb over a wide range of temperatures in large magnetic fields. (auth)

33748 EFFECT OF THERMAL NOISE ON CURRENT-VOLTAGE CHARACTERISTICS OF JOSEPHSON JUNCTIONS. Falco,

C. M. (Univ. of California, Irvine); Parker, W. H.; Trullinger, S. E.; Hansma, P. K. Phys. Rev., B; 10: No. 5, 1865-1873(1 Sep 1974).

Measurements are reported of the current-voltage (I–V) characteristics of externally shunted oxide-barrier tunnel junctions at temperatures T and critical currents I_c such that the Josephson coupling energy $(\hbar/2e)I_c$ is comparable to the thermal energy k T. Results are in complete quantitative agreement with the theory of Ambegaokar and Halperin in the limit that the dimensionless parameter $\beta_c = (2e/\hbar)(I_cC/\sigma^2) < 1$, where C is the capacitance and σ the total conductance of the shunted junction. Measurements for larger values of β_c are in qualitative agreement with the theory of Kurkijärvi and Ambegaokar. In addition, the Ambegaokar-Halperin theory is generalized to include the cosφ pair-quasiparticle interference term. It is concluded that a measurement of the cosφ term using only the I–V characteristic will be difficult. (13 figures) (auth)

33749 EXPERIMENTAL STUDY OF NONEQUILIBRIUM SUPERCONDUCTIVITY. Yu, M. L. Pasadena, CA; California Inst. of Tech. (1974). 162p. University Microfilms Order No. 74-17,959.

Thesis (Ph. D.).

Experimental investigations were made on the transport properties of several superconducting systems in which the superconducting state was out of thermodynamic equilibrium. In such systems, the dynamics of the pairing processes governs the restoration of equilibrium. Systematic investigations into the nonequilibrium dynamics were made possible by creating a steady state depairing region at a supernormal interface with a transport current. Information was obtained by direct probing of the potential profiles in the depairing region. Measurements were made with superconducting microcircuits with high spatial resolution extending to the scale of the wavelength of light which limits our fabrication system. It was found that at the depairing region, the experimental results can be described by the existence of two distinct potentials, one for the single electron excitations and one for the electron pairs. A theory for the dynamics of the nonequilibrium process was proposed and succeeded in accounting for most of the experimental observations. The relaxation time associated with this dynamics is found to be longer than the usual equilibrium relaxation time for the condensed electron pairs. Similar measurements were extended to nonequilibrium regions close to current carrying interfaces between two different superconductors. In this case it was found that the two-potential measurements performed within the nonequilibrium region can be described in terms of a time dependent boundary condition at the interface. To study the nonequilibrium superconductivity associated with this time dependent boundary condition in a controlled way, two such superconducting boundaries were brought very close to each other, creating a well defined boundary region less than one micron in length. It was found that the boundary region showed Josephson-like effects as well as a unique phenomenon in which electromagnetic radiation increases the apparent superconducting transition temperature. A model for this situation was proposed in which two complex wavefunctions with independent phase angles interfere quantum mechanically inside the boundary region. This model successfully explains most of the observed phenomena associated with the boundary region in the voltage sustaining nonequilibrium state. (Diss. Abstr. Int., B)

33750 ELASTIC CONSTANTS OF FLUX LINE LATTICE IN TYPE-II SUPERCONDUCTORS. Khanra, B. C.; Raychaudhuri, A. K. (Saha Inst. of Nuclear Physics, Calcutta). Phys. Status Solidi (b); 65: No. 1, K29-K33(1 Sep 1974).

The elastic constants were calculated by Labusch's method for all values of Ginzburg–Landau parameter and induction. The dependence of the constants on the interaction energy of a vortex was studied from h_{c1} to h_{c2}. (DLC)

33751 TYPE II/1 AND TYPE II/2 SUPERCONDUCTORS. de Cesare, L.; Mancini, F. (Univ., Salerno, Italy). Phys. Status Solidi (b); 65: No. 1, 419-427(1 Sep 1974).

The problem of a first-order transition at the lower critical field in type-II superconductors is investigated by means of the boson formulation of superconductivity. The critical value κ_c of the Ginzburg–Landau parameter which separates type-II/1 from type-II/2 superconductors is theoretically determined and is in good agreement with the experimental value. The distribution of the magnetic field of an isolated flux line and the interaction potential between two flux lines are also computed in the entire region including the core. (31 references) (auth)

33752 MEASUREMENT OF THE VISCOUS FRICTION COEFFICIENT OF THE VORTICES OF SUPERCONDUCTING Nb–80% Zr ALLOY NEAR T_c. Goncharov, I. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Phys. Status Solidi (b); 65: No. 1, K67-K69(1 Sep 1974).

The aim was to measure the viscosity coefficient of recrystallized Nb–80% Zr ribbons close to T_c and to compare it with the microscopic theory. (DLC)

33753 LOW TEMPERATURE SPECIFIC HEAT OF ErAs. Landau, D. P.; Rives, J. E. (Univ. of Georgia, Athens). Solid State Commun.; 15: No. 3, 665-667(1 Aug 1974).

The specific heat of a sintered sample of ErAs has been measured from 1.4 to 6.1°K. A single broad λ-like peak in the data occurs at 3.25°K. The entropy associated with the peak is approximately R ln4 suggesting an $S' = \frac{1}{2}$ ground state. (auth)

33754 DYNAMIC THEORY OF THE COEXISTENCE OF SUPERCONDUCTIVITY AND FERROMAGNETISM. II. Dilute Ferromagnetic Alloy. Izyumov, Yu. A.; Skryabin, Yu. N. (Inst. of Metal Physics, Kiev). Fiz. Metal. Metalloved.; 37: No. 6, 1127-1137(Jun 1974). (In Russian).

For a dilute superconducting ferromagnetic alloy the dynamic correlations in the spin-system are taken into account. A critical concentration n_c is found at which superconductivity is suppressed because of the disruptive effects of three factors: exchange noncoherent scattering of electrons, repulsion of electrons by spin waves, and exchange magnetization of the electrons. A comparison of n_c is carried out with the critical concentration n_c^0 of the theory of Abrikosov-Gor'kov for the paramagnetic state of the impurities. (tr-SJR).

33755 TEMPERATURE DEPENDENCE OF ALTERNATING CURRENT LOSSES IN NbTi FILAMENTS. Critchlow, P. R.; McConnell, R. D. (Hydro-Quebec, Montreal). Cryogenics; 14: No. 9, 487-488(Sep 1974).

An apparatus to measure ac losses in superconducting materials as a function of temperature has been constructed. The ac losses are determined by measuring the temperature rise of a thermally isolated sample. Preliminary data have been obtained on a NbTi single filament. The temperature variation of the ac loss can be attributed to the linear temperature variation of J_c. (auth)

33756 MEASUREMENT OF THE TEMPERATURE DEPENDENCE OF THE 50 Hz ALTERNATING CURRENT LOSSES OF SUPERCONDUCTING STABILIZED NIOBIUM CONDUCTORS. Penczynski, P.; Hentzelt, H.; Eger, G. (Siemens A. G., Erlangen, Ger.). Cryogenics; 14: No. 9, 503-508(Sep 1974).

Measurements in the temperature range of 1.6 to 6 K were carried out on fully stabilized niobium conductors. The calorimeter used for varying the temperature and the electrical measuring method for determining the 50 Hz losses are described. The results obtained agree well with theoretical derivations. The evaluation gives the temperature dependence of characteristic superconductor properties: the lower critical magnetic field strength H_{c_1}, the critical current density j_c, the surface screening field ΔH, and enables certain facts to be stated on the nature of the niobium surface. (auth)

33757 SUPERCONDUCTING JOINT BETWEEN MULTIFILAMENTARY WIRES. Luderer, G.; Dullenkopf, P.; Laukien, G. (Univ., Bochum, Ger.). Cryogenics; 14: No. 9, 518-519(Sep 1974).

A method is described for making superconducting joints between more than 50 filaments of diameters <50μm. The critical data (the critical current as a function of the applied flux density) of a great number of joints were recorded and typical results are given. (UK)

33758 SELF-FIELD DEGRADATION EFFECT IN ADIABATIC CONDITIONS. Duchateau, J. L.; Turck, B. (CEN de Saclay, Gif-sur-Yvette, France). Cryogenics; 14: No. 9, 481-486(Sep 1974).

In multifilamentary superconducting composites mutual inductance between the filaments give rise to self-field degradation effects. Radial current density redistribution is first examined taking into account the spiral field effect. Then the limits of stability in adiabatic conditions imposed on these composites by self-field degradation are examined and the results of experiments carried out on short samples and non-inductive coils under adiabatic conditions are discussed. (auth)

33759 OBSERVATION OF MAGNETIC FLUX FROZEN IN HIGH CONDUCTIVITY METAL DURING FLUX JUMPING IN A TYPE II SUPERCONDUCTOR. Onishi, T. (Electrotechnical Lab., Tonashi, Tokyo). Cryogenics; 14: No. 9, 495-498(Sep 1974).

In the concentric arrangement of a superconducting tube and a high-conductivity aluminium cylinder, the magnetic flux variation

arising from flux jumps occurred only within the superconducting tube itself, whereas the magnetic flux in the normal metal was almost completely frozen during the flux jumps. Provided the magnetic flux was completely frozen in the normal metal, the energy released by flux jump was calculated to be equal to a quarter that released by a complete flux jump. It was found that the magnetic diffusion time-constant was much larger than that given by $L^2/\pi^2 D_m$. (auth)

33760 SUPERCONDUCTORS OF THE SECOND TYPE, PROPERTIES, AND FABRICATION. Levaire, C.; Matricon, M. (Compagnie Francaise Thomson-Houston Hotchkiss-Brandt, Paris). Rev. Tech. Thomson-CSF; 5: No. 4, 761-789(Dec 1973). (In French).

The general properties of superconductors, the definition and properties of superconductors of the second kind, and the structural forms best suited to a satisfactory utilization of these properties are envisaged. The methods used to translate these previously defined structures in hardware and the results obtained are described. (FR)

Equipment and Devices

Refer also to abstracts 32225, 33758, and 33760.

33761 (AD-893472) SUPERCONDUCTIVE MICROWAVE SLOW WAVE STRUCTURES. Final Report. Passow, C. A.; Newhouse, V. L.; Gunshor, R. L. (Purdue Univ., Lafayette, Ind. (USA). School of Electrical Engineering). Jan 1972. Contract F33615-70-CO1125. 71p. (AFAL-TR-72-292). NTIS $6.75.

The study of three superconductive microwave devices is described. A highly compact non-dispersive delay line, a pulse compression circuit, and a switching element whose resonant frequency can be varied electrically. It has been established that by use of simple evaporation and photo-etching techniques, nondispersive microstrip lines with storage times of several tens of microseconds and gigahertz bandwidths can be constructed. The pulse compression study has shown that compression ratios of over 1,000 may be feasible using a superconductive slow wave structure in which radiation losses are negligible. However, such a structure may be impractically large. (GRA)

33762 (COM-74-50306/1) CRYOGENIC PHYSICS SECTION: SUMMARY OF ACTIVITIES, 1973. Annual Report, 1 January-31 December 1974. Soulen, R. J. Jr. (National Bureau of Standards, Washington, D. C. (USA)). Mar 1974. 24p. (NBS-TN-823). GPO $0.60.

The research activities of the cryogenic physics section which specifically relate to thermometry are summarized. The topics range from superconductive fixed points to nuclear orientation thermometry, as well as Josephson junction noise thermometry and paramagnetism. (auth)

33763 (KFK-1991) EXPERIMENTAL STUDIES OF SUPERCONDUCTING Nb HELICAL RESONATORS IN THE REGION OF 100 MHz. Piosczyk, B. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Apr 1974. 99p. (In German). Dep. NTIS (US Sales Only) $8.00

Thesis. Submitted to Univ., Karlsruhe, Ger.

Measurements on superconducting Nb helical resonators are described. Peak magnetic rf-fields up to 1250 Gauss and residual resistance as low as 10^{-9} Ω were obtained. Two contributions to the residual resistance were studied systematically: 1. the contribution of gases condensed on the surface. The following gases were used: N_2, O_2, CO_2, air and N_2/O_2-mixtures. 2. The contribution of frozen-in-flux resulting from externally applied dc magnetic fields up to 6 Gauss. The thickness of the condensed gases studied varied from approximately 1 monolayer to 10^4 monolayers. As a result the loss factor $\tan\delta$ in these condensed layers was determined. Losses in the N_2/O_2 layers were particularly large compared to those found in pure N_2 layers. This difference is caused by the magnetic moment of the O_2 molecule. The additional losses in the 100 MHz-region due to frozen-in-flux show different behavior from losses in the GHz-region. In particular the additional resistance increases with increasing rf-field. This can be explained by a model in which the flux lines perpendicular to the surface are bent by the rf induced Lorentz force. This explanation leads to a pinning frequency of about 20 MHz. (auth)

33764 (KFKI-74-39) ^{3}He-^{4}He DILUTION REFRIGERATOR. Kovac, L.; Balla, J. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1972. 14p. Dep. NTIS (US Sales Only) $4.00.

A description of a simple ^{3}He-^{4}He dilution refrigerator, which is able to cool samples to 50 mK, is presented. It features simplified construction and small size resulting in short cooling down and stabilizing times. (auth)

33765 (KFKI-74-60) COMBINED ^{3}He CRYOSTATS AND ^{3}He-^{4}He DILUTION REFRIGERATORS. Kovac, L.; Balla, J. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1974. 17p. Dep. NTIS (US Sales Only) $4.00.

Equipment built for low temperature range 0.05 to 1.5 K solid state physics research, at the Central Research Institute for Physics in Budapest is described. The He^4 Dewar and the connected systems are able to accommodate two different interchangeable types of inserts, should there be a need to switch from a He^3 evaporation system to a dilution refrigerator or vice versa. (auth)

33766 IMPROVEMENTS IN AND RELATING TO SUPERCONDUCTING DYNAMO-ELECTRIC MACHINES. McNab, R. B.; Mulhall, B. E. (to International Research and Development Co. Ltd.). British Patent 1,351,601. 1 May 1974. Filed date 9 Apr 1970. 5p.

Means are described for screening superconducting windings of dynamo-electric machines from time-varying magnetic fields. Practical superconducting materials show a high power loss when subjected to time-varying magnetic flux. This loss is referred to as "ac loss" and is akin to hysteresis loss in the magnetisation of iron. The machine described has a superconducting dc rotor field winding and an ac stator winding. An electromagnetic flux screen is located between the windings so as to shield the rotor winding from time-varying magnetic flux produced by the stator winding. The rotor comprises an inner part carrying the superconducting winding and an outer part carrying the screen; the two parts are supported coaxially and restrained against relative rotation. The flux screen has the further advantage of preventing eddy current loss in any electrically conductive material present in the region protected by it, for example in the structure supporting the superconducting winding. The screen may take the form of a hollow cylinder. The space between the inner and outer parts of the rotor may be evacuated so as to provide heat insulation for the superconducting winding, and a thermal radiation shield may be located in the evacuated space. Various alternative rotor constructions are described. (UK)

33767 METHOD OF FABRICATING COMPOSITE SUPERCONDUCTIVE ELECTRICAL CONDUCTORS. Strauss, B. P. (to United States Atomic Energy Commission). US Patent 3,836,404. 17 Sep 1974. Filed Date 28 Jun 1972. 6p.

A method is described for fabricating composite superconductive electrical conductors by disposing at least one rod of flexible substrate material into a billet of an alloy of a normal metal and an alloying metal, co-drawing the billet and rod down to form an elongated conductor and heating the conductor to diffuse the alloying metal into the surface of the flexible substrate, forming a layer of superconductive material in the flexible substrate surrounded by a sheath of normal metal alloy. By this method, composite conductors containing any number of superconductive filaments can be fabricated. (auth)

33768 CURRENT COMPARATORS WITH SUPERCONDUCTING SHIELDS. Grohmann, K.; Hahlbohm, H. D.; Luebbig, H.; Ramin, H. (Physikalisch-Technische Bundesantalt, Berlin). Cryogenics; 14: No. 9, 499-502(Sep 1974).

It is shown that the iron cores of conventional current comparators may be replaced by superconducting shields. Their function is to transmit the magnetic field of the exciting ratio windings regardless of their position and shape to a detector winding. A toroidal shield system with two modifications—a nested one and a helical one—has been combined with a SQUID to build up current comparators for dc and ac applications. The smallest dc error was found to be 5×10^{-10}. Finally a practical example is given of the application of high precision cryogenic current comparators. (auth)

PHYSICS (NUCLEAR)

Neutron Interactions with Matter

Refer also to abstracts 33733, 33860, 33931, 34043, and 34338.

33769 (BNL-19046) CALCULATIONAL MODEL FOR THE RESONANCE ABSORPTION IN THE ^{240}Pu 1 eV RESONANCE. Buslik, A. (Brookhaven National Lab., Upton, N. Y. (USA)). Jun 1974. 21p. (RP-1034). Dep. NTIS $4.25.

A model for the inclusion of effects due to the thermal motion and chemical binding of protons on the resonance absorption in the ^{240}Pu 1-eV resonance is presented for a lattice consisting of fuel rods in water. The model converts the heterogeneous problem of a rod in a lattice cell to a homogeneous problem. The procedure used is essentially the same as the procedure used in the multiple-Sauer method [Buslik, Nucl. Sci. Eng. 38, 72 (1969)]; however, an independent derivation based on the Chernick coupled integral equations is given. An approximation is then used for the hydrogen scattering kernel. The resonance absorption is shown to be of the same form as that in HAMMER with a modified Dancoff factor in the resonance integral computation and a modified value of the slowing-down power for hydrogen. (RWR)

33770 (BNL-tr-567) ABSORPTION AND REFLECTION OF ULTRACOLD NEUTRONS. Frank, I. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1974. Translated by S. J. Amoretty of JINR-P3-7810. 22p. Dep. NTIS $4.25.

The peculiarities of the complex index of refraction $n_\gamma = n'_\gamma + in''_\gamma$ are considered. A notion about the neutron velocity in matter is introduced for ultracold neutrons ($V_\gamma < V_\theta$) and for very cold neutrons ($V_\gamma > V_\theta$). The problem of reflection and passage of neutron waves in matter and of ultracold neutron absorption is considered. A hypothesis is suggested that explains the anomaly in the time of storage of ultracold neutrons. (auth)

33771 (COO-3058-54) UTILIZATION OF INTERACTIVE GRAPHICS AND CONTINUOUS SLOWING DOWN THEORY. Danchak, M.; Becker, M.; Moyer, W. R. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA). Div. of Nuclear Engineering). 1974. Contract AT(11-1)-3058. 4p. (CONF-741017-4). Dep. NTIS $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

At RPI, continuous slowing-down theory (CSDT) has been redefined to include inelastic scattering. Even with CSDT simplifications, the process of postulating desired modifications, implementing the modifications in calculations, comparing results with experiment, postulating further modifications, etc., can be cumbersome and time-consuming. This paper reports significantly improved efficiency for the above process by use of the recently developed Rensselaer Interactive Graphics Analysis System. The system allows a user to calculate, display, compare, manipulate, and modify his data without requiring any programming on his part. The scheme was applied to analysis of depleted U and Fe data. For U, all ENDF/B data files led to overpredicted spectra between 50 and 500 keV and to underpredictions in the low-MeV range. For Fe, a data set obtained from the 1124 file yielded reasonably good agreement with experiment. (RWR)

33772 (IEA-310) NEUTRON CROSS SECTIONS OF POLYETHYLENE AND LIGHT WATER IN THE ENERGY RANGE 8.2×10^{-4} to 0.13 eV. Herdade, S. B.; Vinhas, L. A.; Rodrigues, C.; Amaral, L. Q. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Fisica Nuclear). Sep 1973. 25p. Dep. NTIS (US Sales Only) $4.25.

The total neutron cross sections, σ_T, of polyethylene and light water were measured, as a function of neutron wavelength, in the neutron energy interval 0.13 to 8.2×10^{-4} eV by using a chopper-time-of-flight spectrometer and a crystal spectrometer, at the IEA research reactor. The measurement, made with good precision and a great number of points, represents an improvement to the knowledge of σ_T for these materials. The polyethylene experiment results are compared with calculations based on different data and hypothesis about the molecular dynamics of this polymer. The calculated values of Kirouac et al. (Trans Amer. Nucl. Soc. 12, 672, 1969) agree satisfactorily with these results, including the subthermal region ($E < 10^{-2}$ eV), where there was a discrepancy between experimental and calculated values. Results obtained for water are in good agreement with previous measurements, in both the thermal and subthermal regions. They also agree with calculated values based on the models proposed by Koppel–Young and McMurrey–Russel, in the thermal region. The slopes of the scattering cross section per hydrogen atom curves, as a function of neutron wavelength, in the range 4.8 to 10Å were derived. (3 figures, 4 tables) (auth)

33773 (INDC(CCP)-39/U, pp 1-101) GROUP PARAMETERS FOR THE ANISOTROPY OF NEUTRON SCATTERING. Bazazyants, N. O.; Zabrodskaya, A. S.; Nikolaev, M. N. 1972. Translated from Russian report.

The need for group constants that allow scattering anisotropy to be taken into account is pointed out. This paper is devoted to the establishment of a theoretical basis for methods of taking into account elastic and inelastic slowing down of neutrons in multigroup approximations; the development of practical algorithms for calculating group parameters for slowing-down anisotropy (i.e., matrices of cross sections and angular moments of intergroup transitions during scattering), with energy losses due to recoil of the product nucleus taken into account; and the compilation, on the basis of these algorithms, of tables listing the parameters of intergroup transitions in elastic scattering for a wide range of elements. The numerical results obtained for the subdivision adopted in the 26-group system of constants are set out in an appendix. The appendix contains tables of group parameters relating to the anisotropy of elastic neutron slowing down for 42 nuclei from deuterium to ^{239}Pu. The paper is divided into the following sections: kinetic equation for a neutron flux averaged over the resonance structure, multigroup kinetic equations, the kinematics of scattering and the derivation of a formula for the angular momenta of the scattering indicatrix, calculation of the slowing-down matrix, and calculation of group parameters for the anisotropy of elastic neutron scattering. (39 figures, 86 tables) (RWR)

33774 (ORNL-TM-4223) SDT 12. The ORNL Benchmark Experiment for Neutron Transport Through Sodium. Maerker, R. E. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 56p. (ENDF-189). Dep. NTIS $6.00.

An experiment concerning deep neutron penetration in sodium is described, and experimental results in a format for CSEWG shielding integral data testing are presented. These results provide a basis for verification of the accuracy of sodium cross sections used in transport calculations. The experiment was performed at the Tower Shielding Facility of ORNL, and included measurements of both the neutron fluence and neutron spectra behind tanks of sodium up to 15 ft thick. (2 figures, 33 tables) (auth)

33775 (RT/FI-(74)18) FAST REACTOR CROSS SECTION LIBRARIES UP-DATING: ORIGINAL AND ADJUSTED ENDF/B-III DATA IN BONDARENKO FORMAT. Salvatores, M. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Apr 1974. 130p. Dep. NTIS (US Sales Only) $9.50.

The ENDF/B, version 3 data and recent benchmark experiments on the fast critical facilities ZPR-6 and SNEAK were used to derive an up-to-date cross-section library for fast-reactor calculation in the Bondarenko format. Code implementation and general library features are summarized. Tables for a large number of elements are given in an appendix. (2 tables) (auth)

33776 INVESTIGATION OF NEUTRON TRANSPORT PHENOMENA WITH STRONG TIME DEPENDENCE. Sulitze, H. Kiel, Ger.; Kiel Univ. (1972). 52p. (In German). INIS.

Thesis. 13 figs.; 1 tab.; 15 refs. With abstract. Available from the library of Kiel Univ.

A numerical solution of the space, angle, energy and time-dependent transport equation is given for spherical symmetry. With a S_N-method computer program, developed on the basis of the above solution, time-dependent transport processes are investigated which deviate strongly from the quasi stationary state. The results are compared with those from quasistationary calculations. The range of application for both methods is shown. (GE)

33777 INVESTIGATION OF NEUTRON THERMALIZATION IN POLYCRYSTALLINE MODERATORS. Shamasundar, B. I. Atlanta; Georgia Inst. of Tech. (1974). 174p. University Microfilms Order No. 74-16,139.

Thesis (Ph. D.).

A series of measurements to determine accurately the total cross section of polycrystalline beryllium, beryllium oxide, and graphite below the Bragg cut-off energy was made. Measurements were also made to establish accurately the total cross section, above the Bragg cut-off energy, of a beryllium moderator. A theoretical study of the spectra in a $35.56 \times 35.56 \times 50.0$ cm long beryllium moderator was made by using the adjoint Monte Carlo technique. This analysis showed that the first term of the Placzek

kernel, normalized to yield the correct inelastic cross section, can provide a good representation of the inelastic scattering properties of a beryllium moderator. A theoretical study of the total angle-integrated flux, as a function of distance from the source, was made in finite sizes of a beryllium moderator by using the S_N method. It was found that, in a 150 × 150 cm beryllium assembly, the neutron distribution reaches an equilibrium condition fairly rapidly, whereas, in 35.56 × 35.56 cm and 60 × 60 cm beryllium assemblies, the neutron distribution does not reach an equilibrium condition even after a distance of 100 cm from the source plane. These results are in agreement with the published asymptotic transport theory predictions and are in direct disagreement with the corresponding diffusion theory results. This demonstrates the limitations on the use of diffusion theory for small systems with strong transverse leakage. (RWR)

33778 ZAMEDLENIE I POGLOSHCHENIE REZONANSNYKH NEITRONOV. (Moderation and Absorption of Resonance Neutrons). Luk'yanov, A. A. Moscow; Atomizdat (1974). 360p.

The book presents the basic results of studies of the effect of the resonance structure of neutron cross sections on processes of moderation, absorption, and diffusion of neutrons in nuclear reactors and shielding materials. The first section contains a review of present-day achievements of the physics of resonance nuclear reactions and of theoretical methods of calculating neutron cross sections used in reactor physics. The remaining sections consider concrete problems in the theory of neutron transfer in media having resonance cross sections: methods of solving the kinetic equation for homogeneous and heterogeneous media, various approximations of the theory of resonance absorption, and schemes for calculating effective group cross sections in the resonance region. Comparisons of theoretical and experimental results are presented, and recommendations are given for their use in reactor calculations. (18 tables, 17 figures, 387 references) (SJR)

33779 ANALYTICAL EVALUATION OF RESONANCE INTEGRALS. Menon, S. V. G.; Sahni, D. C. (Bhabha Atomic Research Centre, Bombay (India). Reactor Engineering Div.). Atomkernenergie; 23: No. 3, 195-198(1974).

2 tabs.; 9 refs.

By using Fourier transforms and the discontinuity factors the integral equation of neutron slowing down theory in the resonance region is transformed into a differential equation. Analytical expressions are derived for the resonance integrals of isolated resonances of an absorber in an infinite homogeneous mixture of moderator and absorber. (auth)

33780 GENERALIZED SPECTRAL DECOMPOSITION, WITH APPLICATION TO THE REDUCED TRANSPORT OPERATOR. Baird, L. C.; Zweifel, P. F. (Virginia Polytechnic Inst. and State Univ., Blacksburg). Nuovo Cim.; 23B: No. 2, 402-416(11 Oct 1974).

The spectral decomposition of certain unbounded operators can, in some cases, be simplified by a method called "generalized spectral decomposition". The generalized spectrum is not necessarily equal to the spectrum, but several useful containment theorems are proved. This technique is applied to the spectral decomposition of the reduced transport operator in one space dimension. In particular, under the assumption that the scattering kernel is degenerate and each element square integrable, it is shown that the generalized spectral decomposition is identical with the ordinary spectral decomposition. (auth)

33781 SPATIAL DISTRIBUTION OF PHOTONEUTRONS IN AN IRON SLAB PRODUCED BY 20-MeV ELECTRON BOMBARDMENT. Nakamura, T.; Hirayama, H.; Nishino, S.; Hyodo, T. (Kyoto Univ.). Mem. Fac. Eng., Kyoto Univ.; 34: No. 1, 60-70 (Jan 1974).

The photoneutron distribution was measured by activation of aluminum and magnesium in an iron slab bombarded by a beam of 20-MeV electrons from a linear accelerator. In order to compare with the experimental results, the spatial neutron distribution was calculated as follows: the photoneutron source distribution originating from the photonuclear reaction was calculated by an approximate analytical method, and then the neutron distribution in the medium was calculated on the basis of this distributed source by the Monte Carlo code CYGNUS. The calculated neutron distribution was in good agreement with the measured distribution, obtained by using activities of aluminum detectors. From the comparison of both saturated activities of aluminum and magnesium, it was found that the photonuclear effects are remarkable when r is equal to 10 cm and Z is between 2 and 5 cm. The spatial distribution of neutron flux above about 6.5 MeV in the iron slab is nearly spherically symmetric around the beam incident point, and shows an exponential attenuation with the slope of effective removal cross section of iron, Σ_{eff} R = 0.172 cm^{-1}. (auth)

33782 ANALYSIS OF THE NEUTRON TRANSPORT EQUATION UNDER CONDITIONS OF AN INFINITE ENERGY AXIS. Shikhov, S. B.; Shishkov, L. K. Zh. Vychisl. Mat. i Mat. Fiz.; 14: No. 3, 705-716(1974). (In Russian).

A linear homogeneous neutron transport equation of the Boltzmann type is considered for a semi-infinite energy interval from the viewpoint of the existence and singularity of a positive solution. The thermal motion of nuclei in the medium are taken into account on the assumption that the velocity distribution of the nuclei obeys Maxwell's law. The asymptotic properties of neutron cross sections and the properties of transfer operators are investigated. In the general case the existence of a positive solution is proved. The singularity of the solution is established with an additional limitation on the distribution of secondary fission neutrons. The main proof is the theory of positive operators of M. Krein and Krasnosel'skii. (tr-auth)

33783 HALF-RANGE ORTHOGONALITY THEOREM FOR THERMAL-NEUTRON TRANSPORT. Ishiguro, Y. (Cidade Univ., Sao Paulo, Brazil). Nucl. Sci. Eng.; 55: No. 2, 233-234 (Oct 1974).

It is shown that the eigenfunctions of the energy-dependent transport equation with isotropic-scattering degenerate kernel have a half-range orthogonality property. Adjoint functions are expressed in terms of the H matrix introduced by Pahor. (auth)

33784 RANDOMNESS OF A NEUTRON'S KINETIC ENERGY AS IT SLOWS DOWN BY ELASTIC COLLISIONS IN AN INFINITE MEDIUM. Barnett, C. S. (Univ. of California, Livermore). Nucl. Sci. Eng.; 55: No. 2, 234-242(Oct 1974).

The infinite-medium pure-scattering slowing-down model was developed by Fermi and coworkers soon after the discovery of the neutron. The model, although highly idealized, still has conceptual value and is a useful thinking aid. Previous work on the model has been restricted to certain kinds of average behavior. A more detailed look at the random behavior of the kinetic energy of the neutron as it slows down is taken in this paper. Simple recursion arguments are used to find exact expressions for the n'th-flight kinetic energy moments in terms of the corresponding first-flight kinetic energy moments. Complete describing functions are found for the number of the collision at which the neutron lethargy crosses a given value under the assumption of a spherically symmetric scattering law. For example, if the given value of lethargy for hydrogen is u, then this collision number is Poisson distributed with parameter u. The spherically symmetric scattering results are illustrated for six different nuclides. A brief discussion, including a sample calculation, shows how to extend the theory to more general scattering laws and to mixtures. (2 figures) (auth)

33785 INCOMPLETE NEUTRON THERMALIZATION IN LIGHT WATER ICE AT 77, 21, AND 4 K. Gangwani, G. S. (Dyal Singh Coll., New Delhi); Kothari, L. S. Nucl. Sci. Eng.; 55: No. 2, 242-243(Oct 1974).

It has been observed both experimentally and theoretically that cooling ice assemblies below 40 K do not significantly change their steady-state neutron spectra. It is shown that this incomplete thermalization in ice below 40 K is due to diffusion hardening. (1 table) (auth)

33786 MULTIGROUP REPLICATION PROPERTY FOR EXTERNAL, SPHERICALLY SYMMETRIC PROBLEMS OF TRANSPORT THEORY. Zelazny, R.; Duracz, T. (Inst. of Nuclear Research, Swierk, Poland). J. Math. Phys. (N. Y.); 15: No. 9, 1505-1507(Sep 1974).

The replication property for multigroup spherically symmetric external problems in the transport theory is derived and applied to reduce the system of multigroup integral transport equations to a system of planelike singular integral equations, which can be solved by means of well known methods. (auth)

33787 NEUTRONS IN BOTTLES. Golub, R. (Univ. of Sussex, Eng.). New Sci.; 63: No. 911, 450-452(22 Aug 1974).

If experimentalists could store slow neutrons in a trap of some kind they could study some very fundamental aspects of these particles. Such experiments include the measurement of the neutron lifetime and the search for a possible neutron electric dipole moment and these are discussed. Of the three possible methods of exerting significant forces on neutrons—interaction with material surfaces, inhomogeneous magnetic fields, and gravitational fields—the first two, either by themselves or in combination with the others can be used to store neutrons. These are considered. The unexpectedly large wall losses found, mean that, at the present time, a neutron lifetime measurement using storage in material bottles is not feasible. On the other hand, experiments using a magnetic bottle to store neutrons look very attractive. Fortunately, although the wall losses are much larger than ex-

pected they are not so large as to limit the sensitivity of an electric dipole moment experiment. (UK)

33788 SLOWING DOWN OF NEUTRONS IN SEMI-INFINITE CYLINDRICAL PILE. Goyal, S. P. (Banasthali Vidyapith, India); Mathur, S. L. Indian J. Phys.; 48: No. 3, 242-245(Mar 1974).

The problem of finding the slowing down density of neutrons in a semi-infinite cylindrical pile, when there are sources of neutrons in it, for boundary conditions given by Marshak is considered. Different types of integral operators are used to solve the problem. (auth)

Nuclear Properties and Reactions, A ≤ 5

Refer also to abstracts 33103, 33563, 33583, 33885, 33917, and 33930.

33789 (CEA-N-1594, pp 1-7) NUCLEAR PHYSICS. Blachot, J.; Carraz, L. C.; Ferrieu, A. 1972. (In French).

In semi-annual progress report No. 2.

Work effected during the 2nd half of 1972 at the Grenoble Fundamental Research Department in the field of nuclear fission products and the investigation of light nuclei by using fast neutrons is briefly reviewed. Results concerning the mass distribution of ^{235}U fission products and ^{138}Xe decay are given. New experimental data concerning the n + T differential elastic cross section at 14 MeV are presented. (FR)

33790 (KHFTI-73-10, pp 45-47) RADIATIVE K^--MESON CAPTURE BY NUCLEI. Korenman, G. Ya.; Popov, V. P. (Moscow State Univ.). 1973. (In Russian).

The processes of radiative K^- capture by nuclei $K^- + A \rightarrow A\gamma + \gamma$, where $\gamma = \Lambda$, Σ^0, or Σ^- were examined. The γ quanta yield from one negative K^- meson was obtained. The contribution of the different final states of the hypernuclear systems to the complete probability of the process was evaluated. (INIS)

33791 (NP-20118, pp 47-49) SEARCH FOR EXCITED STATES IN ^3He. Tanabe, T. (Tokyo Univ.); Yasue, M.; Sato, K.; Ishizaki, Y.; Koyama, K.; Koori, N.; Ogino, K.; Sakaguchi, H.; Takeuchi, S. 19 Mar 1974.

33792 (USNDC-11, pp 137-139; 140) $^4He(\gamma,p)-(\gamma,n)$ RATIO MEASUREMENT. Phillips, T. W.; Faul, D. D.; Berman, B. L.; Calarco, J. R.; Hall, J. R. (Univ. of California, Livermore). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33793 (USNDC-11, pp 147; 148) TOTAL CROSS SECTIONS OF ^3He AND ^4He. Seagrave, J. D.; Hall. (Los Alamos Scientific Lab., NM). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33794 MOMENTUM DISTRIBUTION OF NUCLEONS FROM THE REACTION D(e,e'p)n AT 1200 MeV IN DEUTERIUM. Antuf'ev, Yu. P.; Agranovich, V. L.; Kuz'menko, V. S.; Sorokin, P. V. (Physical-Technical Inst., Kharkov). JETP Lett. (USSR) (Engl. Transl.); 19: No. 10, 339-340(20 May 1974).

Translated from Zh. Eksp. Theor. Fiz., Pis'ma Red.; 19: No. 10, 657-659(20 May 1974).

The cross section of the reaction D(e,e'p)n at 1200 MeV was measured as a function of the proton emission angle at a constant proton momentum. Within the framework of the plane-wave impulse approximation, the momentum distribution in the deuterium nucleus was determined and compared with the Hulthen distribution. (auth)

33795 MECHANISM OF THE REACTION $D(\pi^-,\pi^-p)n$ AT 1 GeV/c. Bayukov, Yu. D.; Vorob'ev, L. S.; Kolybasov, V. M.; Leksin, G. A.; Stolin, V. L.; Fedorov, V. B. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 20: No. 1, 59-63(Jul 1974). (In Russian).

The knock-out reaction $D(\pi^-,\pi^-p)n$ is experimentally studied at 1.05 GeV/c incident pion momentum with coincidence registration of π^- mesons and protons. The neutron momentum q region is studied up to 200 MeV/c. There are presented the distributions of the number of events in the following variables: q (the neutron momentum), θ (the neutron polar angle), φ (Treiman-Yang angle), p_π (the momentum of scattered π^- meson), $\theta_{\pi p}$ (angle between the outgoing proton and π^- meson), ω (the energy of the π^-p system). In the region q < 80 MeV/c the most sensitive to the mechanism q, θ and φ distributions are in good agreement with the quasi-elastic scattering mechanism. At large q the momentum distribution essentially differs from the predictions based on the pole diagram with usual deuteron wave functions. (auth)

33796 CALCULATION OF THE CROSS SECTION OF TWO-PARTICLE ELECTRODISINTEGRATION OF ^3He AND ^3H NUCLEI WITH ACCOUNT OF THE FINAL-STATE INTERACTION. Tartakovskii, V. K. (Kiev State Univ.). Yadern. Fiz.; 20: No. 1, 46-54(Jul 1974). (In Russian).

High energy electron scattering on the ^3He and ^3H nuclei accompanied by the two-particle nuclear disintegration is considered. The effect of the final-state interaction on the angular distributions of produced nucleons and scattered electrons is studied. The K-harmonics method is applied to describe the three-nucleon system in initial and final states. The final-state wave functions were calculated in the interpolation approach, being developed presently, based on the square-well two-nucleon potentials. They were used also for the initial-state wave functions. A good agreement with the available data on coincidence experiments is obtained. (auth)

33797 MEASUREMENT OF THE YIELDS OF CHARGED PIONS FROM PHOTOPRODUCTION ON DEUTERIUM NEAR THRESHOLD. Adamovich, M. I.; Larionova, V. G.; Kharlamov, S. P. (Lebedev Inst. of Physics, Moscow). Yadern. Fiz.; 20: No. 1, 55-58(Jul 1974). (In Russian).

The angular dependence of the ratio of the cross sections of negative and positive pions produced by photons on deuterons is determined in the energy range from 160 to 220 MeV. The threshold value of the cross section ratio for free nucleons is obtained to be $\sigma^-/\sigma^+ = 1.34 \pm 0.02$ and is consistent with the value $\sigma^-/\sigma^+ = 1.32 + O(\mu^3/M^3)$ given by the limit low energy theorem in the framework of the PCAC hypothesis. (auth)

33798 HILBERT-SCHMIDT METHOD IN THE THREE-PARTICLE PROBLEM, AND DETERMINATION OF THE $t \rightarrow d + n$ AND $t \rightarrow d^* + n$ VERTEX FUNCTIONS. Baryshnikov, A. G.; Blokhintsev, L. D.; Narodetskii, I. M. JETP Lett. (USSR) (Engl. Transl.); 19: No. 9, 315-317(5 May 1974).

Translated from Zh. Eksp. Theor. Fiz., Pis'ma Red.; 19: No. 9, 608-612(5 May 1974).

By solving three-particle integral equations the vertex constants for the virtual decays $t \rightarrow d + n$ and $t \rightarrow d^* + n$ were calculated, where d^* is a singlet deuteron. The values $G^2_{td^*n} = 1.92$ F and $G^2_{td^*n} = -0.380$ F were obtained in a model with a spin-dependent separable potential. This is the first time that the constant $G^2_{td^*n}$ has been calculated. (auth)

33799 CHARGE FORM FACTOR OF ^4He. Fuyuki, M.; Nagata, S. (Kyoto Univ.). pp 265-272 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33800 N-D SCATTERING AT MEDIUM ENERGIES AND CORRECTIONS TO GLAUBER'S THEORY. Kolybasov, W. M.; Kondratyuk, L. A. (Inst. for Theoretical and Experimental Physics, Moscow). pp 347-358 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33801 HIGH ENERGY HADRON SCATTERING ON LIGHT NUCLEI: EFFECT OF SHORT RANGE CORRELATIONS. Guardiola, R. (Univ. of Barcelona). pp 433-448 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

Nuclear Properties and Reactions, 6 ≤ A ≤ 19

Refer also to abstracts 33772, 33801, 33831-33833, 33929, and 33930.

33802 (KHFTI-73-10, pp 38-41) UNIFIED DESCRIPTION OF INELASTIC AND QUASI-ELASTIC ELECTRON SCATTERING BY NUCLEI. Balashov, V. V.; Grishanova, S. I.; Kabachnik, N. M.; Kulikov, V. M.; Titarenko, N. N. (Moscow State Univ.). 1973. (In Russian).

The inelastic scattering of high energy electrons on nuclei with excitation of the giant resonance level and quasi-elastic scattering,

corresponding to the direct knock-out of nucleons from the nucleus (both processes relating to processes of electrodisintegration of the nucleus) were examined in the framework of the unified model. The electrodisintegration cross section at different momenta and angular correlation functions between electrons and knocked-out nucleons for various proton energies was calculated for ^{12}C by the strong channel bond method. (INIS)

33803 (KHFTI-73-10, pp 42-44) TRANSITIONS ON THE DISCRETE LEVELS AT RADIATIVE CAPTURE OF π^- MESONS BY LIGHT NUCLEI. Karapetyan, V. V.; Koreman, G. Ya.; Popov, V. P. (Moscow State Univ.). 1973. (In Russian).

The transitions to discrete levels of the final nucleus in the reaction $A(\pi^-\gamma)B$ with stopped π^- mesons were examined. The probabilities of transitions to bound states of positive parity were calculated for ^6Li, ^{10}B, ^{12}C, and ^{14}N and to bound states with negative parity for ^{16}O. (INIS)

33804 (NP-20118, pp 13-15) STUDY OF CLUSTER-LIKE STRUCTURE OF ^{12}C BY THE REACTION $^{12}C(p,^6Li)^7Be$. Kato, S. (Tokyo Univ.); Kubono, S.; Hasegawa, T. 19 Mar 1974.

33805 (NP-20118, pp 15-16) STUDY OF THE REACTIONS $^{12}C(p,t)^{10}C$ AND $^{12}C(p,^3He)^{10}B$. Yasue, M. (Tokyo Univ.); Koyama, K.; Kubono, S.; Yokomizo, H.; Omata, K.; Ohnuma, H.; Takeuchi, S. 19 Mar 1974.

33806 (NP-20118, pp 16-19) ELASTIC AND INELASTIC SCATTERING OF 51.9 MeV PROTONS FROM ^{12}C. Kanai, T. (Tokyo Univ. of Education); Mikumo, T.; Tagishi, Y.; Fujisawa, T.; Wada, T.; Kamitsubo, H.; Koike, M. 19 Mar 1974.

33807 (NP-20118, pp 19-20) STUDY OF THE REACTION $^{16}O(p,t)^{14}O$. Kubono, S.; Kato, S.; Yasue, M.; Koyama, K.; Ohnuma, H. (Tokyo Univ.). 19 Mar 1974.

33808 (NP-20118, pp 20-21) STUDY OF THE $^{19}F(p,t)^{17}F$ AND $^{19}F(p,^3He)^{17}O$ REACTIONS. Hasegawa, T.; Koyama, K.; Soga, F.; Tanaka, M.; Yasue, M.; Yokomizo, H. (Tokyo Univ.). 19 Mar 1974.

33809 (NP-20118, pp 46-47) $^{12}C(^3He,d)^{13}N$ REACTION. Tanabe, T. (Tokyo Univ.); Yasue, M.; Sato, K.; Koyama, K.; Ishizaki, Y.; Ogino, K.; Sakaguchi, H.; Takeuchi, S.; Loori, N. 19 Mar 1974.

33810 (NP-20118, pp 114-115) PRODUCTION OF ^7Be FROM PROTON BOMBARDMENT OF LIGHT ELEMENTS. 19 Mar 1974.

33811 (ORNL-TM-4494) ANALYSES OF NEUTRON SCATTERING AND GAMMA-RAY PRODUCTION INTEGRAL EXPERIMENTS ON CARBON FOR NEUTRON ENERGIES FROM 1 TO 15 MeV. Cramer, S. N.; Oblow, E. M. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 74p. Dep. NTIS $6.75.

The results of two integral experiments on carbon, performed at ORNL and IRT, were compared with Monte Carlo calculations to test the evaluated carbon neutron and gamma-ray production data. The experiments were designed to measure with NE-213 detectors the angular dependence of neutron scattering and gamma-ray production from a thick (1 mfp) carbon sample in the energy range from 1 to 13 MeV. Additional measurements in the ORNL experiment also provided the angular dependence of the secondary energy distribution of scattered neutrons. Multigroup Monte Carlo calculations modeling the two experimental arrangements were made to compare with the measured data. Both ENDF/B-III and ENDF/B-IV carbon data were used in the computations. The results indicate that such experiments are adequate for testing processed neutron scattering and gamma-production data (both integral and doubly differential) to within 15% over the entire range of incident neutron energies (1 to 15 MeV). Also, on the whole, the carbon ENDF/B-IV data gave fairly good agreement between the calculated and the measured results over the energy range tested. The only notable exception was the disagreement in the neutron result comparisons above 9 MeV, which were attributed to the $C(n,n')3\alpha$ being too low in this range. (46 figures, 1 table) (auth)

33812 (USNDC-11, pp 108; 109-112) MEASUREMENT OF GAMMA-RAY PRODUCTION CROSS SECTIONS FOR NITROGEN. Orphan, V.; Rogers, V.; Hoot, C.; Verbinski, V. (Intelcom Rad Tech, San Diego, CA). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33813 (USNDC-11, pp 108; 113; 114-117) MEASUREMENTS OF THE $^6Li(n,\alpha)T$ AND THE $^{10}B(n,\alpha)^7Li$ CROSS SECTIONS FOR NEUTRON ENERGIES FROM 1 TO 1500 keV. Friesenhan, S. (Intelcom Rad Tech, San Diego, CA). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33814 (USNDC-11, pp 149-150; 152) WEAK GAMMA TRANSITIONS FROM $^9Be(n,\gamma)^{10}Be$ AND RADIATIVE CAPTURE OF THERMAL NEUTRONS BY ^9Be. Jurney, E. T. (Los Alamos Scientific Lab., NM). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33815 (USNDC-11, pp 194-195) NEUTRON TOTAL CROSS SECTION OF ^6Li FROM 100 eV TO 1 MeV. Harvey, J. A.; Hill, N. W. (Oak Ridge National Lab., TN). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33816 A DWBA ANALYSIS OF POLARIZATION OF PROTONS FROM THE $^9Be(d,p_0)^{10}Be$ REACTION AT E_d = 5.5, 13.8 AND 20.5 MeV. Bondouk, I. I. (Atomic Energy Establishment, Inshas (Egypt). Nuclear Physics Dept.). Atomkernenergie; 23: No. 4, 283-284(1974).

1 fig.; 1 tab.; 21 refs.

The polarization of protons from the $^9Be(d,p_0)^{10}Be$ reaction has been analyzed in terms of the DWBA theory at the deuteron energies 5.5, 13.8 and 20.5 MeV. Good fits were obtained which show the usefulness of the DWBA theory for describing polarization by using the suitable optical model parameters. (auth)

33817 ($^{12}C,^8Be$) AND ($^{16}O,^8Be$) REACTIONS ON ^{12}C, ^{16}O, AND ^{28}Si NUCLEI. Artz, J. L. Tallahasee, FL; Florida State Univ. (1974). 237p. University Microfilms Order No. 74-18,065.

Thesis (Ph. D.).

The above reactions were studied by means of an $\alpha-\alpha$ coincidence technique for the detection of ^8Be. Typical spectra for the ($^{12}C,^8Be$) reactions on ^{12}C and SiO_2 targets indicated selective population of the $K^\pi = 0^+$ ground-state rotational band of ^{16}O, both the $K^\pi = 0^+$ ground-state and $K^\pi = 0^-$ rotational bands of ^{20}Ne, and relatively strong population of the 2.23-MeV(2^+) and especially the 5.01(3^-) state of ^{32}S. For the $^{12}C(^{12}C,^8Be)^{16}O$ reaction the measured cross sections include a complete angular distribution at $E_{c.m.} = 21.0$ MeV and excitation functions at $\theta_{c.m.} \simeq 9°$ and 45° from $E_{c.m.} = 16.5$ to 21.0 MeV. For the $^{16}O(^{12}C,^8Be)^{20}Ne$ reaction the measured cross sections include a complete angular distribution at $E_{c.m.} = 24.0$ MeV, the backward angle data obtained from the $^{12}C(^{16}O,^8Be)^{20}Ne$ reaction. Excitation functions at the forward angles of $\theta_{c.m.} \simeq 8°$ and 40° were measured from $E_{c.m.} = 18.9$ to 24.0 MeV and at the backward angle of $\theta_{c.m.} \simeq 171°$ from $E_{c.m.} = 15.4$ to 25.7 MeV. For the $^{28}Si(^{12}C,^8Be)^{32}S$ reaction the measured cross sections include those that are resolved at the same laboratory energies and angles of the forward-angle data of the $^{16}O(^{12}C,^8Be)^{20}Ne$ reaction. A relatively smooth excitation function is observed for the 5.01 MeV(3^-) state of ^{32}S, in marked contrast to gross fluctuations of from 0.2 to 1.5 MeV width observed for the other mentioned excitation functions. For the $^{16}O(^{16}O,^8Be)^{24}Mg$ reaction a few small cross sections are reported at forward angles and for energies in the vicinity of $E_{c.m.} = 28$ MeV. The anomalous resonance at $E_{c.m.} = 19.7$ MeV for $^{12}C + ^{16}O$ elastic scattering data was investigated for the $^{16}O(^{12}C,^8Be)^{20}Ne$ reaction. This resonance also appears to be visible, although weakly, for both forward- and backward-angle excitation functions. An additional resonance for the back-angle excitation function for the $^{16}O(^{12}C,^8Be)^{20}Ne$ reaction was apparent at $E_{c.m.} = 16.7 \pm 0.1$ MeV for the three low-lying members of the ground-state rotational band of ^{20}Ne but not for the unresolved 5.63(3^-) and 5.79(1^-) states. The full finite-range distorted-wave Born-approximation (DWBA) code MERCURY and the Hauser–Feshbach code STATIS were utilized in attempts to explain the larger forward-angle cross sections observed compared to the backward-angle cross sections for the $^{16}O(^{12}C,^8Be)^{20}Ne$ reactions. The calculations made in this study did not account for the large cross sections observed. (RWR)

33818 STUDY OF THE LEVEL STRUCTURE OF ^{19}Ne, USING THE REACTION $^{17}O(^3He,n\gamma)^{19}Ne$. Davidson, J. M. College Park, MD; Univ. of Maryland (1973). 113p. University Microfilms Order No. 74-17,036.

Thesis (Ph. D.).

The reaction $^{17}O(^3He,n\gamma)^{19}Ne$ at incident energies of 3.0, 4.0, and 5.0 MeV was used. Fourteen previously unreported transitions were identified in $n-\gamma$ coincidence spectra, and lifetime limits for seven states were determined by using the Doppler-shift attenuation method. Precise determinations of the excitation energies of states in ^{19}Ne were made. Analogs in ^{19}F of ^{19}Ne states were identified on the basis of γ branchings. In addition, evidence is presented to suggest that the previous report of a level at 4.78 MeV in ^{19}Ne is erroneous. The displacements in excitation of these mass 19 analog pairs fall into two classes: those for which the ^{19}F member lies below the ^{19}Ne member by 100 to 200 keV, and those for which there is essentially no displacement. Coulomb energy calculations were made. It is shown that states of the first type may be identified as core-excitation states (i.e., 4p–1h

states), while those of the second type are based primarily on 3p–0h configurations. Observed level lifetimes and γ branching are used to deduce limits on spin for ^{19}Ne levels at 4.03 ($J \leq 5/2$), 4.14 ($J \geq 1/2$), 4.20 ($J \geq 1/2$), 4.38 ($J \geq 1/2$), 4.55 ($J \leq 3/2$), 4.60 ($J \geq 3/2$), 4.63 ($J \geq 13/2$), and 5.10 MeV ($J \geq 5/2$). (RWR)

33819 DYNAMICAL CORRELATIONS OF NUCLEONS AND SCATTERING OF ELECTRONS BY NUCLEI AT HIGH ENERGIES. Dzhbuti, R. I.; Kezerashvili, R. Ya. (Inst. of Physics, Tbilisi, USSR). Yadern. Fiz.; 20: No. 1, 33-45(Jul 1974). (In Russian).

Ripka diagram expansion is used to study the nuclear charge form factors. The convergence of the Mayer diagram expansion is investigated. It is shown that the one-pair correlation approximation is insufficient to describe the short range dynamical correlations in light nuclei. But for comparatively heavy nuclei the multipairing effects smooth out and the one-pair approximation may be sufficient to describe the data. The mass number dependence of the radius of short range correlations is studied. It is shown that the range of the dynamical correlation region is almost the same for the nuclei in the interval $4 \leq A \leq 40$. For the nuclei ^{4}He, ^{12}C, ^{16}O and ^{40}Ca the experimentally observed structure of the charge form factor is explained for both regions of small (shell structure) and large (correlation structure) q. For a number of cases the additional diffractional minima are predicted for a region of large q. The charge form factors of the ^{28}Si and ^{32}S nuclei are calculated. The experimental check of the results for those nuclei is interesting for both shell and correlation structure approaches. (auth)

33820 EXCITATION OF INDIVIDUAL LEVELS IN ^{16}O BY PROTONS OF ENERGY 1 GeV. Manaenkov, S. I. (Moscow State Univ.). JETP Lett. (USSR) (Engl. Transl.); 19: No. 9, 308-310(5 May 1974).

Translated from Zh. Eksp. Theor. Fiz., Pis'ma Red.; 19: No. 9, 593-597(5 May 1974).

Form factors obtained by fitting electron data were used to calculate the differential cross sections of the excited levels at 6.05, 6.13, 6.92, and 7.12 MeV in ^{16}O by protons with E = 1 GeV. The results are compared with the experimental data. (auth)

33821 PRESENT STATUS OF THE SACLAY (e,e'p) EXPERIMENTS. Bussiere, A.; Mougey, J.; Ho, P. X.; Priou, M.; Royer, D.; Sick, I. (CEN de Saclay, Gif-sur-Yvette, France). pp 60-67 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33822 DOUBLE-NUCLEON EMISSION FOLLOWING PION ABSORPTION USING THE FADDEEV EQUATIONS IN THE FINAL STATE. Garcilazo, H. (Univ., Mainz); Eisenberg, J. M. pp 449-460 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33823 AN ANALYSIS OF SOME RECENT RESULTS ON PHOTO-PROTONS FROM HIGH-ENERGY BREMSSTRAHLUNG. Dougan, P.; Forkman, B.; Stiefler, W. (Lund Univ. (Sweden). Fysiska Institutionen); Matthews, J. L. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Nuclear Science). Z. Phys.; 269: No. 2, 105-109(1974).

4 Figs.; 17 Refs.

Some recent experimental data on photo-proton emission from carbon, copper, silver and gold irradiated with bremsstrahlung of maximum energy 400 MeV are compared with the results of calculations using the quasi-deuteron model. (auth)

33824 YIELD CURVES FOR PHOTO-PROTON EMISSION FROM CARBON AND BERYLLIUM. Dougan, P.; Stiefler, W. (Lund Univ. (Sweden). Fysiska Institutionen). Z. Phys.; 269: No. 2, 97-104(1974).

5 Figs.; 4 Tabs.; 10 Refs.

The yields of photo-protons at laboratory angles of 40 and 70° from carbon irradiated with bremsstrahlung of end-point energies between 125 and 1,000 MeV are given. From these data and a more limited set for beryllium, the shapes of the cross sections for photo-proton emission by monochromatic photons are deduced. From a separate series of measurements on carbon at 70° lab with bremsstrahlung of end-point energies 380 and 420 MeV, the energy spectrum of photo-protons emitted by photons of energies 400 ± 20 MeV has been derived. (auth)

33825 ISOBARIC SPIN DOUBLETS IN ^{16}O NEAR 13 MeV EXCITATION. Marolt, G. L. Notre Dame, IN; Univ. of Notre Dame (1974). 135p. University Microfilms Order No. 74-20,050.

Thesis (Ph. D.).

The 13-MeV region in ^{16}O was investigated with a variety of charged-particle reactions to confirm the report of the 13.129-MeV(3^-) and 13.02-MeV(2^+) states and to determine their excitation energies and widths to a greater accuracy. The description of three T = 1, T = 0 doublets at 13.258-, 13.129-MeV(3^-), 13.093-, 12.438-MeV(1^-) and 12.967-, 12.528-MeV(2^-) as isobaric spin doublets was investigated. The ^{16}O states were observed as final states in reactions leaving ^{16}O as a residual nucleus. The relation between the ratio of partial widths for decay in a given channel for members of an isobaric spin doublet was extended to the proton and neutron decay channels. Qualitative agreement of isobaric spin mixing parameters determined for the ^{16}O isobaric spin doublets from the ratio of reduced widths of members of that doublet is found among the various channels. The relative T = 1, T = 0 populations for the ^{16}O isobaric spin doublets were determined for the ^{19}F(p,α)^{16}O reaction. The results obtained by fitting the spectra with a two-level multichannel line shape are consistent with the relative T = 1, T = 0 populations being equal for the ^{16}O isobaric spin doublets near 13 MeV, under the same reaction conditions. (RWR)

33826 FOUR-PARTICLE MODEL OF ^{16}O AND α–^{12}C SCATTERING. Kharchenko, V. F.; Kuz'minchev, V. E. (Inst. of Theoretical Physics, Kiev). Yadern. Fiz.; 20: No. 2, 334-339(Aug 1974). (In Russian).

Nucleus ^{16}O and the α–^{12}C scattering are considered in framework of the four-α-particle model basing on the integral equations of motion for the four particles formulated previously. The interaction between two α-particles is described by means of a separable potential. The first excited 0^+ state is found in the four-α-particle system with the energy somewhat lower than the (α + ^{12}C) threshold. The amplitude of the pure nuclear α–^{12}C scattering at zero energy is calculated. (auth)

33827 FORM FACTORS FOR TWO-NUCLEON CLUSTER TRANSFER. Bang, J. M.; Elin, T.; Schulz, G. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 20: No. 2, 346-353(Aug 1974). (In Russian).

A coupled-channels method for calculation of form factors for two-particle transfer is suggested. The method permits clustering effects for the two-particles to be taken into account using realistic nuclear potentials. It is used for calculation of ^{12}C(t,p)^{14}C, yielding angular distributions in rather good agreement with experiments.

33828 PARITY-FORBIDDEN ALPHA DECAY OF ^{16}O. Fai, G. (Eotvos Univ., Budapest); Nemeth, J.; Apagyi, B. ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 129-140(1974).

Nuclear forces have a small parity-violating part due to the parity violation of the weak interaction. Attention is directed to the parity-forbidden alpha decay of the 8.87-MeV, 2^- level of ^{16}O. This excited state can decay into an alpha particle and the ground state of the ^{12}C nucleus with L = 2 angular momentum. The calculation is done with first-order perturbation theory. An expression for the parity-nonconserving width of this level is obtained. This expression contains quantities that must be evaluated by using some kind of alpha-decay theory (a reliable one does not exist) and solving the nuclear many-body problem. (3 figures) (RWR)

33829 DIRECT PARITY VIOLATING TRANSITIONS IN NUCLEI. Fiorini, E. (Univ., Milan). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 119-128(1974).

Several experiments on parity nonconservation in nuclei are briefly described. The importance of investigating direct parity-violating alpha decays or alpha interactions is brought out. Most experiments have studied alpha decay of the excited states of ^{16}O. Values for the parity-violating widths for several levels are given. (5 figures) (RWR)

33830 JASTROW CORRELATIONS IN α-CLUSTER MODEL AND NUCLEAR CHARGE FORM FACTORS. Dzhibuti, R. I.; Kezerashvili, R. Ya. (Inst. of Physics, Tbilisi, USSR). Yadern. Fiz.; 20: No. 2, 340-345(Aug 1974). (In Russian).

The Jastrow short-range correlations are introduced into the α-cluster model and the charge form factors in elastic electron scattering are calculated for nuclei ^{12}C, ^{16}O, ^{20}Ne, ^{24}Mg, ^{28}Si, and ^{32}S. It is shown that an account of the dynamical short-range correlations results in an essential improvement of the agreement between the theoretical and experimental form factors. The considered model enables one to conclude on the extent of the cluster separation depending on the mass number. (auth)

Nuclear Properties and Reactions, 20 ≤ A ≤ 38

Refer also to abstracts 33817, 33819, 33821, 33830, 33848, 33874, 33885, 33886, 33916, 33917, 33930, and 34010.

33831 (KFTI-73-26, pp 63-65) THE EFFECT OF NUCLEI TRANSPARENCY ON THE PION PHOTOPRODUCTION CROSS-SECTION DEPENDENCE ON MASS NUMBER. Grishaev, I. A.; Emets, N. L.; Pugachev, G. D.; Ranyuk, Yu. N. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high physics and nuclear physics.

The results of calculations of the transparency of C, Al, Cu, and Pb nuclei to pions formed inside a nucleus as a result of the action of high-energy bremsstrahlung are reported. The calculations were made for a cascade model by a Monte Carlo method for a nuclear model with a constant density. The calculated values are compared with experimental values. (INIS)

33832 (NP-20118, pp 21-22) ANALYSIS OF THE $^{28}Si(p,d)^{27}Si$ AND $^{18}O(p,d)^{17}O$ REACTIONS. Ohnuma, H. (Tokyo Univ.); Tanabe, T.; Suehiro, T.; Takeda, S.; Nakanishi, N.; Yamada, S. 19 Mar 1974.

33833 (NP-20118, pp 59-61) PHOTON TAGGING SYSTEM AND MEASUREMENT OF TOTAL ABSORPTION CROSS SECTIONS IN CARBON, ALUMINUM, AND COPPER BY THE TAGGED PHOTON BEAM. Arai, S.; Homma, S.; Kasuya, M. (Tokyo Univ.). 19 Mar 1974.

33834 (USNDC-11, pp 153; 154) $^{33}S(n,\alpha)$. Auchampaugh, G. F.; Howard. (Los Alamos Scientific Lab., NM). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33835 LIFETIMES OF EXCITED STATES OF ^{38}K. Longo, D. S. Notre Dame, IN; Univ. of Notre Dame (1974). 99p. University Microfilms Order No. 74-19,537.

Thesis (Ph.D.).

The reaction $^{40}Ca(d,\alpha\gamma)^{38}K$ was used to produce states of ^{38}K up to approximately 4.5 MeV in excitation. The results of a study of several other nuclear reactions for the population of excited states of ^{38}K are also given. A deuteron beam at a bombarding energy of 7.84 MeV was produced by the Notre Dame FN Tandem Van de Graaff accelerator and focused onto targets fabricated by the vacuum evaporation of natural calcium metal onto silver foils. Alpha particles were detected near $\theta_{lab} = 180°$ with an annular silicon surface barrier detector in coincidence with gamma rays detected with a 40-cm^3 Ge(Li) detector at $\theta_{lab} = 90°$ and 144°. The Doppler-shift-attenuation method was used to measure the mean lifetimes of five excited states of ^{38}K for which no previous lifetime value has been reported, namely (E_x in keV, τ_m in fsec) 3430, <170; 3613, 700^{+130}_{-105}; 3686, 375^{+134}_{-134}; 3699, >1170; and 4335, 345^{+83}_{-230}. The mean lifetime measurements for ten additional excited states of ^{38}K are in agreement with previously reported lifetime values. Transition strengths were calculated for each of the transitions in ^{38}K measured in this work by using published branching ratios. Reduced transition probabilities were calculated for some of the low-lying excited states of ^{38}K and compared with theoretical predictions. The following spin and parity assignments are suggested (E_x in keV, J^π): 3699, (3^-); 3934, (3^-); and 4335, (4^-). Isospin values are also suggested for several excited states of ^{38}K. (Diss. Abstr. Int., B)

33836 PROBABILITY OF SPIN-FLIP AT INELASTIC SCATTERING OF PROTONS ON $^{28}Si(E_p \simeq 6$ MeV). Andronov, Yu. F.; Vinogradov, L. L.; Chubinskii, O. V.; Sadkovskii, V. S.; Denisov, A. E.; Kolalis, R. P.; Feofilov, G. A. (Leningrad State Univ.). Yadern. Fiz.; 20: No. 1, 10-16(Jul 1974). (In Russian).

Experimental investigation of the spin-flip probability for inelastic scattering of protons with energy near 6 MeV on ^{28}Si with excitation of the first 2^+ state ($Q = -1.78$ MeV) is carried out. The spin-flip probability S was measured by means of the $(p'\gamma)$ coincidences as function of the proton scattering angle in the angle interval from 40 up to 150° (l.s.). A rather small variation of the proton energy changes S by a factor of 1.5 to 2 but the angular dependence is intact. The observed angular dependence of S at $E_p \simeq 6$ MeV is considerably different from the published data for $E_p = 30$ and 40 MeV. The conclusion is drawn that the contribution from the resonance process to the inelastic scattering of 6-MeV protons on ^{28}Si is substantial. (auth)

33837 VECTOR ANALYZING POWER AND CROSS SECTION FOR THE REACTION $^{36}Ar(\vec{d},p)^{37}Ar$. Sen, S.; Yoh, W. A.; McEllistrem, M. T. (Univ. of Notre Dame, IN). Phys. Rev., C; 10: No. 3, 1050-1062(Sep 1974).

Cross section and vector analyzing power for the reaction $^{36}Ar(\vec{d},p)^{37}Ar$ were measured for an incident deuteron energy of 10.02 MeV. The data were analyzed in the framework of the distorted-wave Born approximation. The J dependence of the vector analyzing power permits unambiguous spin-parity assignments to be made for 19 states in ^{37}Ar with excitation energies up to 8.40 MeV. Tentative spin assignments are made to the states with excitation energies 8.093 and 8.399 MeV. Most probable spin-parity values for the constituents of the unresolved (5.880 + 5.961) MeV and (7.246 + 7.282) MeV groups in the spectra are suggested from an analysis of the data. Spectroscopic factors are extracted using deuteron optical model potential parameters obtained from a simultaneous analysis of the elastic cross section and vector analyzing power data. Results of the analysis for the 2.217 and 7.131 MeV states indicate the possible importance of reaction processes other than the one-step stripping mechanism. (auth)

33838 (p,^{3}He) AND (p,t) REACTIONS ON ^{29}Si. Nann, H.; Benenson, W.; Lanford, W. A.; Wildenthal, B. H. (Michigan State Univ., East Lansing). Phys. Rev., C; 10: No. 3, 1001-1012(Sep 1974).

Differential cross sections of the $^{29}Si(p,^3He)^{27}Al$ and $^{29}Si(p,t)^{27}Si$ reactions between $\theta_{lab} = 4$ and 60° were measured at 40.1 MeV bombarding energy. Assignments of the L transfers on the basis of comparisons to distorted-wave Born approximation (DWBA) calculations yield several new spin and parity assignments for states in ^{27}Si. The experimental differential cross sections of the transitions to several of the low-lying mirror pairs of final states in ^{27}Al and ^{27}Si are compared to the results of microscopic DWBA calculations in order to study the spin-isospin dependence of the interaction potential in the two-nucleon transfer reaction and to test current shell-model wave functions for the nuclear states involved. (auth)

33839 EXPLANATION OF RESONANCES IN NEUTRON SCATTERING ON NUCLEI. Verbitskii, V. P.; Zaichenko, A. K.; Ol'khovskii, V. S. (Kiev State Univ.). Yadern. Fiz.; 20: No. 2, 354-355(Aug 1974). (In Russian).

Based on the generalized optical model the energy dependence of cross section of the neutron elastic scattering on ^{24}Mg is studied in the regions beneath and above the threshold of the inelastic scattering with excitation of the first 2^+ level of this nucleus. An explanation of the resonance structure of the under-threshold scattering cross section is proposed. (auth)

33840 FAST NEUTRON CROSS SECTION OF ^{24m}Na. Plostinaru, D.; Ivanov, E. A.; Iordachescu, A.; Vajda, S.; Pascovici, G. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 25: No. 4, 387-392(1973). (In Rumanian).

By using the pulsed beam technique and the internal irradiation method of the NaI (Tl) crystals, the cross section of ^{24m}Na, excited by ^{23}Na (n, γ) reaction of fast neutrons was measured. The cross sections obtained are: $\sigma \simeq 0.1$; 0.1; and 0.12 mb, at neutron energies of 0.92; 2.28; and 3.95 MeV, respectively. The large experimental error (~40%) is due especially to the large background of diffused neutrons. (auth)

Nuclear Properties and Reactions, 39 ≤ A ≤ 58

Refer also to abstracts 33821, 33854, 33856, 33869, 33874, 33875, 33885, 33886, 33917, 33930, 33942, and 34010.

33841 (JINR-P1-8041) INVESTIGATION OF ISOTOPE EFFECTS IN PRODUCTION PROCESSES FOR CHARGED PIONS IN PROTON INTERACTIONS WITH NUCLEI. Balin, D. V.; Batusov, Yu. A.; Bogatin, V. I.; Bondarev, V. K.; Litvin, V. F.; Dozhkin, O. V.; Oganesyan, K. O.; Porokhovoi, S. Yu.; Yakovlev, Yu. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 13p. Dep. NTIS (U. S. Sales Only) $4.00.

The effects of the characteristics of the nucleus-target structure on the yields of π^+ and π^- mesons were studied. The relative yields of pions from separated pairs of ^{58}Ni and ^{64}Ni and of ^{112}Sn and ^{124}Sn, having significant differences in the number of neutrons, was measured. The values obtained for the differential cross sections for the pion energy level from 37 to 42 MeV at an angle of 90° were tabulated. The experimental results indicate the presence of a strong isotope effect in the yield of π^- mesons and in the ratio of the yields of π^+ to π^- mesons for the elements studied. No isotope effect was observed for the production of π^+ mesons. The results obtained for the ratio Y_A^+/Y_A^- for ^{58}Ni and ^{112}Sn agree well with results obtained previously for Cu and Ag. Charge

exchange processes of the incident protons and π^0 mesons generated by the protons on supplementary neutrons seems to be the factor increasing the yield of π^- mesons on neutron-rich isotopes. (JSR)

33842 (KFTI-73-26, pp 61-62) PHOTOPRODUCTION OF CHARGED PIONS ON ^{54}Fe- AND ^{56}Fe-NUCLEI. Grishaev, I. A.; Lapin, N. I.; Pugachev, G. D.; Shramenko, B. I. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high energy physics and nuclear physics.

The results of studies on photoproduction of π^+ and π^- mesons on ^{54}Fe and ^{56}Fe nuclei with gamma quanta having an E_{max} of 500 MeV are reported. The difference between the energy spectra obtained and those proposed by the authors was considered to be related to the nuclear structure of the targets. (INIS)

33843 (NP-20118, pp 25-26) ^{55}Mn(p,t)^{53}Mn REACTION. Miura, K.; Hiratate, Y.; Suehiro, T. (Tohoku Inst. of Tech., Sendai). 19 Mar 1974.

33844 (NP-20118, p 50) TEST OF A COUNTER TELESCOPE SYSTEM WITH 82 MeV ^{3}He BEAM. Soga, F. (Tokyo Univ.); Yasue, M.; Ohkawa, S.; Fushimi, K.; Hasegawa, T.; Ohnuma, H.; Ishizaki, Y.; Kokame, J.; Yamaguchi, H. 19 Mar 1974.

33845 (USNDC-11, pp 67-68; 78-79; 92-94) NEUTRON RESONANCE SPECTROSCOPY, CALCIUM. Singh, U. N.; Liou, H. I.; Rainwater, J.; Hacken, G.; Makofske, W.; Garg, J. B. (Columbia Univ., New York). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33846 DETERMINATION OF THE NUCLEON INELASTIC CROSS SECTION FOR THE NUCLEI OF IRON AND LEAD AT ENERGIES OF 1.0 TeV. Mamidzhanyan, E. A.; Martirosov, R. M. (Erevan Inst. of Physics). Yadern. Fiz.; 20: No. 1, 107-111(Jul 1974). (In Russian).

The nucleon inelastic interaction cross sections for Fe and Pb nuclei at the energy of ~1.0 TeV are found to be $\sigma_{nFe}^{in} = 698 \pm 47$ mb, $\sigma_{nPb}^{in} = 1800 \pm 234$ mb (for neutrons), $\sigma_{Fe}^{in} = 731 \pm 34$ mb, $\sigma_{Pb}^{in} = 1840 \pm 187$ mb (for all the events selected). A slight increase of the hadron cross sections is detected in case of iron. In the energy range 0.6 to 4.0 TeV the cross section is increased by about 7%. The law $\sigma_A = \sigma_0 A^{\alpha}$ was estimated based on the results with $\alpha = 0.71 \pm 0.04$. (auth)

33847 GIANT QUADRUPOLE RESONANCES IN NUCLEI. Gul'karov, I. S. (Tashkent Polytechnic Inst.). Yadern. Fiz.; 20: No. 1, 17-20(Jul 1974). (In Russian).

The giant resonance spectra of the isotopes ^{58,60,64}Ni are presented. The results of studying of the giant quadrupole resonance in nuclei by means of inelastic scattering of electrons, protons and ^{3}He ions are systematized. The mean excitation energy of the giant quadrupole resonance in the nuclei from ^{27}Al to ^{209}Bi is within a good accuracy determined by the formula 63 $A^{-1/3}$ MeV. The experimental data are compared with the energy weighed sum rule. The radiative widths of the giant dipole resonance increase linearly with A, but the A dependence of the widths of the giant quadrupole resonance is more complicated. (auth)

33848 CROSS SECTIONS OF ALUMINUM AND IRON AVERAGED OVER THE ^{252}Cf FISSION NEUTRON SPECTRUM. Alberts, W. G.; Matzke, M. (Physikalisch-Technische Bundesanstalt, Brunswick). Nucl. Sci. Eng.; 55: No. 2, 243-244(Oct 1974).

Preliminary results from the measurement of the cross sections of the reactions ^{27}Al(n,α)^{24}Na and ^{56}Fe(n,p)^{56}Mn with ^{252}Cf fission neutrons are compared with values calculated by using energy-dependent cross sections and neutron energy spectra. (auth)

33849 PROBLEMS IN QUASI-FREE SCATTERING AT HIGH MISSING ENERGY. ^{40}Ca As An Example. Frullani, S. (Laboratori di Fisica, Rome). pp 68-87 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33850 METHOD TO CALCULATE PROBABILITIES OF NUCLEAR DOUBLE β DECAY. Khodel, V. A. (Inst. of Atomic Energy, Moscow). Yadern. Fiz.; 20: No. 2, 317-325(Aug 1974). (In Russian).

A method to calculate the nuclear matrix elements $M^{2\nu}$ of the two-neutrino double β decay is presented. The method is based on the principle of the diagram selection, used in the quantum electrodynamics at deduction of the low energy theorem for the bremsstrahlung. Equations are obtained to calculate $M^{2\nu}$ via the constants introduced in the theory of finite Fermi systems. The concrete calculations are fulfilled for the decay ^{48}Ca $\rightarrow$ ^{48}Ti + $2e^-$ + $2\bar{\nu}$. (auth)

33851 ELASTIC SCATTERING OF α PARTICLES ON TITANIUM ISOTOPES. Gonchar, V. G.; Tokarevskii, V. V. (Inst. of Nuclear Research, Kiev). Yadern. Fiz.; 20: No. 2, 261-265 (Aug 1974). (In Russian).

The differential cross sections of the elastic scattering of the 27.2 MeV α particles on the isotopes $^{46-50}$Ti are measured at the laboratory angles from 30 to 173°. It is found that at large c.m. angles (140 to 173°) the absolute cross section value for the ^{49,50}Ti isotopes is several times as large as the scattering cross section for ^{46,48}Ti. The cross section for ^{47}Ti is between the two mentioned above. (auth)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 33823, 33831, 33833, 33841, 33847, 33864, 33874, 33875, 33885, 33889, 33917, 33930, 33964, and 34010.

33852 (COO-2186-17) ANNUAL REPORT OF THE NUCLEAR ACCELERATOR LABORATORY, JUNE 1, 1973-MAY 31, 1974. (State Univ. of New York, Albany (USA). Dept. of Physics). Jun 1974. Contract AT(11-1)-2186. 100p. Dep. NTIS $8.00.

After an introductory summary, various projects in nuclear, solid state, and atomic physics are briefly described. These include both basic studies of the atomic interaction involved in heavy-ion collisions and applications to trace element analysis. Complementary x-ray studies with MeV electrons and high-energy heavy ions have also been undertaken, along with work on radiation damage and ion implantation. Accelerator operation, theses, grants, personnel, and publications are included as well. Four of the papers, containing significant information, are separately title listed. (RWR)

For title listings of individual papers see: 32232, 33524, and 33525.

33853 (NP-20118, pp 29-30) STRUCTURE OF ^{74}Se. Orihara, H. (Tohoku Univ., Sendai); Ishizaki, Y.; Hiratate, Y.; Suehiro, T.; Miura, K.; Yamaguchi, H. 19 Mar 1974.

33854 (ORO-1797-51) ELASTIC SCATTERING OF ^{14}N BY ^{40}Ca, ^{56}Fe, ^{62}Ni, ^{70,74}Ge, ^{90}Zr, AND ^{118}Sn. Williams, M. E.; Davis, R. H.; Delaune, C. I.; Hudson, G. M.; Kemper, K. W.; Zeller, A. F. (Florida State Univ., Tallahassee (USA)). 1974. Contract AT(40-1)-1797. 24p. Dep. NTIS $4.25.

Elastic scattering of ^{14}N by ^{40}Ca, ^{56}Fe, ^{62}Ni, ^{70,74}Ge, ^{90}Zr, and ^{118}Sn was studied in the region of the Coulomb barrier in order to extract optical-model parameters and interaction barrier heights. Angular distributions were measured in 10° steps from 20° or 30° to 170° over an energy range of 24 to 54 MeV. Although barrier heights determined from the optical-model parameters were 20% lower than the static Coulomb barrier $Z_1 Z_2 e^2/1.35(A_1^{1/3} + A_2^{1/3})$, they are consistent with those calculated by several models. (7 figures, 3 tables) (auth)

33855 (ZFK-273) EXPERIMENTAL RESULTS OF SPECTROSCOPIC INVESTIGATIONS OF THE ISOTOPES ^{76,78,80,82}Se. Mueller, H.; Wohlfarth, D.; Hentschel, E. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Apr 1974. 44p. (In German). Dep. NTIS (U. S. Sales Only) $5.25.

The results of particle-gamma coincidence measurements in the reactions ^{76,78,80,82}Se(p,p'γ) and ^{76,78,80,82}Se(α,$\alpha'\gamma$) as well as the results of inelastic proton scattering on the target nuclei ^{76,78,80,82}Se and of lifetime measurements concerning levels in the isotopes ^{76}Se and ^{78}Se, are given. In the four isotopes 85 previously unreported levels were established. (34 figures, 8 tables) (auth)

33856 PARTIAL NEUTRON CROSS SECTIONS FOR ^{82}Se, ^{81}Br, ^{45}Sc, AND ^{96}Ru AT 15.1 MeV. Kao, T. S. Auburn, AL; Auburn Univ. (1974). 72p. University Microfilms Order No. 74-19,387.

Thesis (Ph. D.).

Activation techniques were used to measure the cross sections at 15.1 MeV neutron energy for the following reactions: ^{82}Se(n,2n)^{81m,g}Se, ^{81}Br(n,2n)^{80m,g} Br, ^{45}Sc(n,2n)^{44m,g} Sc, ^{96}Ru(n,2n)^{95}Ru and ^{96}Ru(n,d + n,np + n,pn)^{95g}Tc. The energetic neutrons were produced by the ^{3}H(d,n)^{4}He reaction with the Auburn University 3-MeV Dynamitron accelerator. Isomeric cross section ratios were evaluated by applying the least-squares fit method to the time behavior of gamma ray activity originating from the ground state of each isomeric pair. The absolute cross sections were measured by the mixed-powder method with ^{27}Al(n,α)^{24}Na reaction as the

monitor for one member of each isomeric pair. The cross sections for the formation of the other member of the pairs were determined by the isomeric cross section ratios. The isomeric cross section ratios and the cross sections are compared to the theoretical values obtained from calculations based on the statistical model for the formation of a compound nucleus and its subsequent emission of neutrons. (Diss. Abstr. Int., B)

33857 DISINTEGRATION OF HEAVY NUCLEI WITH EMISSION OF FAST HELIUM NUCLEI AT 67 GeV/c PROTON MOMENTUM. Borisenko, A. I.; Kazanskaya, A. P.; Morozova, P. V.; Takibaev, Zh. S.; Titova, N. S. (Kazakh State Univ., Alma-Ata, USSR). Yadern. Fiz.; 20: No. 1, 101-106(Jul 1974). (In Russian).

The main characteristics of disintegration of heavy photoemulsion nuclei followed by emission of fast helium isotopes are studied at 67 GeV/c proton momentum. The experimental data were compared at 60 GeV pion energy in the 9.0 to 67 GeV energy range of the incident protons. The assumption is made that the mechanism of production of the helium nuclei with kinetic energy from 100 to ~2500 MeV remains the same in a wide energy region of the primary particles. (auth)

33858 DECAY OF 0.30 s ^{64}Co. Rahkonen, V.; Kantele, J. (Jyvaeskylae Univ., Finland). (Phys. Fenn.; 9: No. 2, 103-109 (Jun 1974).

From irradiations of ^{64}Ni with 14-15 MeV neutrons, a 0.30 ± 0.03 s activity is definitely assigned to ^{64}Co. On the basis of beta- and gamma-ray spectrometric studies, the ground-state spin of ^{64}Co is established as 1 +, which indicates a configuration different from that of the lowest levels in ^{58,60,62}Co. (auth)

33859 LEVELS OF ^{77}Br POPULATED IN THE DECAY OF ^{77}Kr AND A UNIFIED MODEL DESCRIPTION OF ^{77,79,81,83}Br ISOTOPES. Houdayer, A.; Mark, S. K.; Kitching, J. E.; Paradellis, T. (McGill Univ., Montreal). Phys. Fenn.; 9: No. 2, 85-102(Jun 1974).

The decay of ^{77}Kr was investigated using γ-ray and conversion electron measurements. Thirty-one transitions following this decay were observed and placed in a proposed decay scheme comprising fourteen excited states in ^{77}Br. From the results of these measurements the log ft values for the various decay branches were deduced, and spin-parity assignments for the ground state of ^{77}Kr and the states of ^{77}Br were made. In addition, the level structure and electromagnetic properties of ^{77,79,81,83}Br were described within the context of a unified model, and good agreement with experimental results was obtained. (auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 32331, 32844, 33789, 33841, 33854, 33856, 33857, 33900, 33905, 33919, 34010, and 34016.

33860 (ANCR-1157) RADIOACTIVE-NUCLIDE DECAY DATA FOR ENDF/B. Reich, C. W.; Helmer, R. G.; Putnam, M. H. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Aug 1974. Contract AT(10-1)-1375. 21p. (ENDF-210). Dep. NTIS $4.00.

A file of radioactive-nuclide decay data for ENDF/B was established. The information is stored on magnetic tape in a readable card-image format. For each nuclide (or isomeric state) the atomic number, mass number, and half-life are given, together with the observed decay modes (including β^-, β^+, electron-capture, isomeric-transition, α, delayed-neutron, and spontaneous-fission decay). For each decay mode the associated branching ratio and the available decay energy (where defined) are listed. For each radiation type, the energies and intensities of the individual transitions are given, together with a normalization factor to convert relative intensities to absolute intensities. In addition, intensity-weighted average energies are included for β, γ, and α transitions. For the individual γ-ray transitions, provision is made for inclusion of their total internal conversion coefficients. Uncertainties for all the measured quantities are also given. Documentation of the sources from which the data were taken and other pertinent information are included as comments for each nuclide. The format in which the data are prepared (and from which they are translated into the ENDF/B format) is presented and discussed. A list of the 198 nuclides for which decay data are included in this file as of June 1974, and in Version IV of ENDF/B is given. (auth)

33861 (ANL/NDM-8) FAST NEUTRON CAPTURE AND ACTIVATION CROSS SECTIONS OF NIOBIUM ISOTOPES. Poenitz, W. P. (Argonne National Lab., Ill. (USA)). May 1974. Contract W-31-109-eng-38. 32p. Dep. NTIS $4.75.

The radiative neutron-capture cross section of ^{93}Nb was measured from 0.3 to 2.5 MeV. A large liquid scintillator and the time-of-flight technique were used to detect the prompt capture γ rays. A gray neutron detector was employed as a neutron flux monitor. The data were normalized at 0.5 MeV to the capture cross section of ^{197}Au. Capture and activation cross sections of ^{93}Nb and ^{94}Nb were calculated in terms of the statistical model of Hauser and Feshbach and the statistical gamma cascade model reported previously. (10 figures, 2 tables) (auth)

33862 (BNL-19168) THERMAL NEUTRON CAPTURE ON ^{142}Ce. Gelletly, W.; Kane, W. R.; Gasten, R. F. (Brookhaven National Lab., Upton, N.Y. (USA)). 1974. 6p. (CONF-740920-11). Dep. NTIS $4.00.

From 2nd international symposium on nuclear capture gamma-ray spectroscopy; Petten, Netherlands (2 Sep 1974).

The gamma rays from thermal neutron capture on ^{142}Ce were studied in singles and coincidence with Ge(Li) detectors. A level scheme for ^{143}Ce was established. The intensities of the primary gamma rays to levels below 2 MeV appear to be correlated with the strengths of excitation of the levels in the (d,p) reaction, which correlation suggests that direct capture is important in this reaction. (1 figure, 1 table) (auth)

33863 (DEU-73-20) ANNUAL REPORT 1972. Martin, B. (comp.). (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). 1973. 289p. (In German).

The annual 1972 report of the M.P.I. for Nuclear Physics in Heidelberg consists of contributions from the fields of nuclear physics and cosmic chemistry. Most of the contributions on nuclear physics originate from the Tandem van de Graaff accelerator and the cyclotron laboratory, where numerous types of reactions have been investigated. (285 figures, 57 tables) (GE)

33864 (INDC(CCP)-39/U, pp 102-125) GROUP CROSS-SECTIONS FOR THE CAPTURE OF FAST NEUTRONS BY FISSION FRAGMENTS. Abagyan, L. P.; Nikolaev, M. M. 1972. Translated from Russian report.

The results of averaging evaluated fragment capture cross sections over a standard spectrum within the groups of a 26-group breakdown are given. Group constants in 1 to 14 groups are given for both individual isotopes and their natural mixtures. The method for calculating the cross sections is listed; it was done primarily on the basis of Hauser-Feshbach theory. The effect of the giant dipole resonance was taken into account, and the level density was calculated on the basis of the Fermi gas model, with allowance for the pairing energy. The tabulation includes capture cross sections for fission fragments of ^{233}U, ^{235}U, and ^{239}Pu calculated on the basis of total yields. (2 tables) (RWR)

33865 (KHFTI-73-10, pp 77-80) PION-NUCLEI INTERACTIONS AT ENERGY 60 GeV. Chasnikov, I. Ya.; Takibaev, Zh. S.; Anzon, Z. V.; Kanygina, E. K. (Inst. of High Energy Physics, Alma-Ata, USSR). 1973. (In Russian).

The results of the investigation of the pion-nuclei interactions using nuclear photoemulsions and new data on the multiplicity, by angular momentum, of the secondary particles formed during interaction of pions with nuclei were reported. (INIS)

33866 (NP-20110) PROGRESS REPORT 1970-1972. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 1972. 78p. (In French). Dep. NTIS (U. S. Sales Only) $7.00.

Summaries are given of the studies made and results obtained in the areas of radioelements, extra-nuclear effects, nuclear archeology, apparatus and techniques of nuclear spectrometry, on-line mass spectrometric studies, nuclear astrophysics, irradiation effects in natural minerals, and isotope separators. A tabulation of the publications during this two-year period which give the complete results of the individual studies is appended. (JSR)

33867 (NP-20118, pp 32-35) ELECTRIC MONOPOLE TRANSITIONS IN ^{100}Ru. Koike, M. (Tokyo Univ.); Kawakami, H.; Komura, K.; Yamada, H. 19 Mar 1974.

33868 (NP-20118, pp 35-38) EXCITATION OF TWO QUASI-PARTICLE 5$^-$ AND 7$^-$ STATES IN THE ^{124,125,128,130}Te(p,t). Matoba, M. (Kyushu Univ., Fukuoka); Hyakutake, M.; Yagi, K.; Aoki, Y.; Rangacharyulu, C. 19 Mar 1974.

33869 (NP-20118, pp 43-46) ^{58}Ni(^{3}He,α)^{57}Ni AND ^{92}Mo(^{3}He,α)^{91}Mo REACTIONS AT 82 MeV. Sekiguchi, M. (Tokyo Univ.); Ohnuma, H.; Hasegawa, T.; Tanabe, T.; Hirao, Y.; Yokomizo, H.; Orihara, H.; Tohei, T. 19 Mar 1974.

33870 (NP-20118, pp 49-50) EXCITATION OF THE DEEPLY BOUND $g_{\frac{7}{2}}$ NEUTRON HOLE STATE IN ^{117}Sn BY NEUTRON PICKUP REACTION WITH 81.7 MeV ^{3}He PARTICLES. Sakai, M. (Tokyo Univ.); Sekiguchi, M.; Soga, F.; Hirao, Y.; Yagi, K.; Aoki, Y. 19 Mar 1974.

33871 (UCID-16037) STATUS REPORT TO USNDC. Bowman, C. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 May 1972. Contract W-7405-eng-48. 16p. Dep. NTIS $4.00.

This status report discusses work on neutron physics (capture cross-section measurements, investigation of γ-ray emission preceding isomeric fission, two-parameter measurement of neutron total cross sections, the microscopic ^{130}Ba(n,γ) cross section and the origin of ^{131}Xe on the moon, thermal-neutron cross sections of ^{257}Fm and ^{253}Cf, intense source of 14-MeV neutrons, neutron yield from ^{9}Be(d,n), heavy ions (theory of effective charge and stopping power for heavy ions), and computer facilities (magnetic drum storage assembly). Two of the papers, containing significant information, are title listed separately. (RWR)

For title listings of individual papers see: 33872 and 34034.

33872 (UCID-16037, pp 2-3) MICROSCOPIC ^{130}Ba(n,γ) CROSS SECTION AND THE ORIGIN OF ^{131}Xe ON THE MOON. Browne, J. C.; Berman, B. L. 5 May 1972.
In Status report to USNDC.

33873 (USNDC-11) REPORTS TO THE U. S. NUCLEAR DATA COMMITTEE. Bowman, C. D. (comp.). (National Bureau of Standards, Washington, D. C. (USA)). Jun 1974. 283p. (EANDC(US)-188-U; INDC(USA)-65-U). Dep. NTIS $7.60.

The reports in this document were submitted to the United States Nuclear Data Committee in June 1974. They include data from 16 laboratories having a substantial effort in measuring neutron and nuclear cross sections. This material is generally of a preliminary nature. The following subjects are included: microscopic neutron cross sections relevant to the nuclear energy program, including shielding (and inverse reactions where pertinent); charged-particle cross sections relevant to the above or to developing and testing nuclear models; gamma-ray production, radioactive decay, and theoretical developments in nuclear structure which are applicable to nuclear energy programs; and proton and alphaparticle cross sections at energies up to 1 GeV, which are of interest to the space program. Thirty-two of the reports, containing significant information, were selected for separate title listing. (RWR)

For title listings of individual papers see: 32254, 33792, 33793, 33812-33815, 33834, 33845, 33874-33882, 33906-33911, 33923, and 33944-33950.

33874 (USNDC-11, pp 3-4; 5; 6) EVALUATION OF DECAY-SCHEME DATA. Helmer, R. G.; Greenwood, R. C. (Aerojet Nuclear Co., Idaho Falls, ID). Jun 1974.
In reports to the U. S. Nuclear Data Committee.

33875 (USNDC-11, pp 11-12) INTEGRAL CROSS SECTION MEASUREMENTS. Harker, Y. D. (Aerojet Nuclear Co., Idaho Falls, ID). Jun 1974.
In reports to the U. S. Nuclear Data Committee.

33876 (USNDC-11, pp 25; 27) NEUTRON TOTAL AND SCATTERING CROSS SECTIONS OF THE ISOTOPES OF MOLYBDENUM AND ZIRCONIUM. Smith, A.; Guenther, P.; Whalen, J. (Argonne National Lab., IL). Jun 1974.
In reports to the U. S. Nuclear Data Committee.

33877 (USNDC-11, pp 42-45) FLUCTUATION PROPERTIES OF RADIATIVE WIDTHS IN ^{149}Sm. Becvar, F.; Chrien, R. E.; Wasson, O. A. (Brookhaven National Lab., Upton, NY). Jun 1974.
In reports to the U. S. Nuclear Data Committee.

33878 (USNDC-11, p 47) TOTAL CAPTURE CROSS SECTION FOR ^{98}Mo. Rimawi, K.; Chrien, R. E. (Brookhaven National Lab., Upton, NY). Jun 1974.
In reports to the U. S. Nuclear Data Committee.

33879 (USNDC-11, pp 49-53) VALENCY MODEL TEST AT 24 keV. Rimawi, K.; Chrien, R. E. (Brookhaven National Lab., Upton, NY). Jun 1974.
In reports to the U. S. Nuclear Data Committee.

33880 (USNDC-11, pp 68; 80) CROSS SECTION, RESONANCE PARAMETERS, AND STRENGTH FUNCTION OF CERIUM-140. Hacken, G.; Liou, H. I.; Makofske, W. J.; Rahn, F.; Rainwater, J.; Singh, U. N. (Columbia Univ., New York). Jun 1974.
In reports to the U. S. Nuclear Data Committee.

33881 (USNDC-11, pp 191-192) TOTAL NEUTRON CROSS SECTIONS OF THE ISOTOPES OF Zr. Good, W. M.; Harvey, J. A.; Hill, N. W. (Oak Ridge National Lab., TN). Jun 1974.
In reports to the U. S. Nuclear Data Committee.

33882 (USNDC-11, pp 215-217) MASSES OF TECHNETIUM ISOTOPES. Comfort, J. R.; Finlay, R. W.; McKenna, C. M.; Debevec, P. T. (Univ. of Ohio, Athens). Jun 1974.
In reports to the U. S. Nuclear Data Committee.

33883 GIANT-DIPOLE-RESONANCE EFFECTS IN THE ^{90}Zr (p,p') 0_1^+ TO 0_2^+ TRANSITION. Geramb, H. V.; Strobel, G. L.; Sprickmann, R. (Kernforschungsanlage, Juelich, Ger.). Nuovo Cim., 23A: No. 3, 447-458(1 Oct 1974).

A fully antisymmetrized distorted-wave analysis for a one- and two-step reaction mechanism is employed to describe inelastic proton scattering. Virtual excitation of the giant dipole resonance occurs in the intermediate state. The microscopic-model description is able to account for the absolute magnitude and shape of the differential cross-section for the 0_1^+ to 0_2^+ monopole transition. The major contributions come from the two-step amplitude. Antisymmetrization in the two-step mechanism provides for important blocking effects and is essential to enable the two-step mechanism to contribute at all. This calculation enlarges the old core polarization knock-out mechanism. (auth)

33884 EFFECT OF LASER RADIATION ON NUCLEAR DECAY PROCESSES. Goldanskii, V. I.; Letokhov, V. S. (Inst. of Chemical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 2, 513-516 (Aug 1974). (In Russian).

The possibility of observing the effect of ionization of radioactive atoms by laser radiation on the rates of internal conversion (in ^{99m}Tc as an example) and K-capture (in ^{7}Be) is considered. (auth)

33885 NUCLEAR DATA SHEETS: RECENT REFERENCES. Nucl. Data Sheets; 13: No. 1, 1-132(Sep 1974).

This publication is a current guide to experimental nuclear physics papers, issued three times per year. The information is described by a key word string, from which the user should be able to tell whether the indexed papers contain results relevant to his interests. Each issue supplements earlier ones, the present volume covering literature received by the Nuclear Data Project or assigned key numbers between January 1 and April 30, 1974. Recent references contains three major sections: key numbers and key words, reaction index, and references. (RWR)

33886 IMPROVED ACTIVATION MEASUREMENTS OF (n,γ) CROSS SECTION FOR 14.6-MeV NEUTRONS. Rigaud, F. (CEN de Bordeaux-Gradignan, Le Haut-Vigneau, France); Desthuilliers, M. G.; Petit, G. Y.; Irigaray, J. L.; Longo, G.; Saporetti, F. Nucl. Sci. Eng.; 55: No. 1, 17-23(Sep 1974).

Activation radiative-capture cross sections of 14.6-MeV neutrons in ^{27}Al, ^{50}Ti, ^{51}V, ^{103}Rh, ^{127}I, and ^{139}La were measured to check and extend to other nuclei recent improved activation measurements. The measured activities strongly depend on the target-head material, on the tritium target backing, and on the sample thickness, whose influence is taken into account in the present experiment. The results of the improved activation measurements agree with each other and also with (n,γ) cross sections deduced from integration of measured gamma-ray spectra: they thus confirm that a large part of earlier activation measurements were in error. Agreement between experiment and theory is obtained with calculations based on the direct and semidirect models. (4 figures, 2 tables) (auth)

33887 ALPHA SCATTERING ON FOUR ZIRCONIUM ISOTOPES. Fetrow, C. M. Jr. Tallahassee, FL; Florida State Univ. (1973). 164p. University Microfilms Order No. 74-18,030.
Thesis (Ph. D.).

Elastic alpha particle scattering differential cross sections from 30° to 170° were measured for the four zirconium isotopes ^{90}Zr, ^{91}Zr, ^{94}Zr, and ^{96}Zr for bombarding energies from 18 MeV to 24 MeV for ^{90}Zr, ^{91}Zr, and ^{96}Zr and between 18 MeV and 25.5 MeV for ^{94}Zr. Four-parameter optical-model analyses were performed on the data sets. Optical-model parameters for the 24-MeV data were extracted for different assumptions of the radius of interaction. An anomalously large peak-to-valley difference in the cross section at large angles was observed for the ^{90}Zr and ^{91}Zr scattering when compared to ^{94}Zr and ^{96}Zr which could not be explained by optical-model scattering with a Saxon-Woods potential but which was adequately explained by using the folding model, simply on the basis of a difference in geometry. The large-angle data of all isotopes for the lower energies were larger than could be predicted by the optical model with or without compound elastic scattering, or the folding model. These are explained in terms of angular momentum dependence of the absorption potential, which provides the correct variations with

energy and isotope of these cross sections. There were observed well-defined differences between the four isotopes which were of geometrical and structural origin attributed to a shell-closure effect. (Diss. Abstr. Int., B)

33888 MASSY ATOMOV I ENERGII SVYAZI YADER. (Atomic Masses and Nuclear Binding Energy). Kravtsov, V. A. Moscow; Atomizdat (1974). 344p.

Atomic masses and the nuclear binding energies calculated from them are very important nuclear properties. If they are known, it is easy to determine the energies of nuclear reactions, the stability of nuclei, and other properties. The pattern of change in binding energy permits verification of the truth of different nuclear models and suggests properties of as yet undiscovered nuclei. Complete and precise tables are given of atomic masses, nuclear binding energies, proton separation energies, and other related properties and their systematics. Determinations and results of measurements, methods of calculation, and a selection of old and new tables are presented. A description of the basic nuclear models and the systematics of nuclear binding energies based on existing models are given. (88 figures, 15 tables, 281 references) (tr-auth)

33889 SPIN-DEPENDENT PROBABILITIES OF ISOMERIC STATE EXCITATION IN (n,γ) REACTION. Bak, H. I.; Yoo, K. J.; Lee, C.; Kim, H. J. Seoul Nat. Univ. Fac. Pap., Sci. Technol. Ser. C; 2: 27-34(1974).

The cross-section ratios for the production of the nuclear isomeric pairs $^{80}Br^{m,g}$, $^{81}Se^{m,g}$, $^{104}Rh^{m,g}$, $^{116}In^{m,g}$, and $^{134}Cs^{m,g}$ through the radiative thermal-neutron capture process were studied. The experimental values of these ratios obtained by the activation method were compared with the calculations deduced from the Huizenga–Vandenbosch method modified by excluding the zero–zero transitions of angular momentum in each gamma-ray cascade. Agreement between these values within 30% could be attained by controlling the spin cut-off parameter and gamma-ray multiplicity. (Korean Sci. Abstr.)

33890 COMPILATION OF PHENOMENOLOGICAL OPTICAL-MODEL PARAMETERS. Perey, C. M.; Perey, F. G. (Oak Ridge National Lab., TN). At. Data Nucl. Data Tables; 13: No. 4, 293-337(1974).

Presented here is a compilation, with bibliography, of optical-model parameters determined by fitting elastic-scattering angular distributions for various incident particles including heavy ions. Only parameters published in the 1969–1972 are included. (auth)

33891 PHOTONEUTRON CROSS SECTIONS FOR ^{112}Sn, ^{118}Sn, ^{120}Sn. Sorokin, Yu. I.; Yur'ev, B. A. (Moscow State Univ.). Yadern. Fiz.; 20: No. 2, 233-241(Aug 1974). (In Russian).

The curves of the photoneutron yields are measured and the (γ, Tn) cross sections on ^{112}Sn, ^{118}Sn and ^{120}Sn isotopes are obtained from threshold energies up to ~27.5 MeV. The integral cross sections up to 27 MeV energy are respectively 2.23, 2.64 and 2.69 MeV · mb. The photoneutron multiplicity corrections were introduced to determine the cross section of nuclear photoabsorption. The results are compared with the shell model calculations and with the theory of finite Fermi systems. The experimental cross sections are considerably larger than the theoretical values at energies higher than 20 MeV. The difference between the mean-square radii of the proton and neutron distributions for ^{112}Sn and ^{124}Sn is estimated. (auth)

33892 PROPERTIES OF THE LOW LYING COLLECTIVE STATES OF EVEN MOLYBDENUM ISOTOPES. Dzholos, R. V.; Denau, F.; Kartavenko, V. G.; Yanssen, D. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 20: No. 2, 310-316(Aug 1974). (In Russian).

The collective Hamiltonian constructed in the framework of the nuclear microscopic model is used to analyze the properties of the low lying collective states of some even Mo isotopes. It is shown that in spite of the relatively small excitation energy, the 0_2^+ states in $^{96,98,100}Mo$ are not deformed as it was supposed earlier. (auth)

33893 CROSS SECTIONS OF NEUTRON RADIATIVE CAPTURE BY TELLURIUM ISOTOPES WITH APPLICATION TO THE THEORY OF NUCLEOGENESIS. Bergman, A. A.; Romanov, S. A. (Inst. of Nuclear Research, Moscow). Yadern. Fiz.; 20: No. 2, 252-260(Aug 1974). (In Russian).

Energy dependencies of the neutron capture cross sections are obtained in the energy region 100 eV to 60 keV for seven tellurium isotopes ($^{122-126,128,130}Te$). The method of the slowing-down time was used by means of a neutron spectrometer. The obtained data were used to consider the astrophysical problem of the nucleogenesis. Average effective cross sections for the Maxwell spectrum of neutrons with κT from 500 eV up to 40 keV are determined from the experimental data and are compared with the theory of s process of creation of heavy elements. The results are in agreement with the conventional hypothesis of the s process of creation of heavy elements from the nuclei of the ferrum group and do not contradict the hypothesis that in nature the s process may happen after the r process creating new nuclei from nuclei produced in the r process. (auth)

33894 ASYMMETRY IN ANGULAR DISTRIBUTIONS OF PHOTONEUTRONS FROM MEDIUM-WEIGHT AND HEAVY NUCLEI. Lazareva, L. E.; Lepestkin, A. I.; Sidorov, V. I. (Inst. of Nuclear Research, Moscow). Yadern. Fiz.; 20: No. 2, 242-251(Aug 1974). (In Russian).

Angular and energy distributions of photoneutrons from ^{103}Rh, ^{181}Ta, ^{197}Au and ^{209}Bi are measured at bremsstrahlung gamma-irradiation with maximal energy $E_{\gamma\,max}$ = 28.5 MeV. The measured energy spectra are compared with the energy spectra of neutrons produced in identical conditions at the maximal energy $E_{\gamma\,max}$ = 20 MeV. (auth)

33895 RADIOACTIVITY STUDY OF ^{93}Mo LEVELS. Charvet, A.; Chery, R.; Phnoc, D. H.; Duffait, R.; Morgue, M. (Univ., Lyon). J. Phys. (Paris); 35: No. 3, 199-203(Mar 1974). (In French).

The decays of the ^{93}Tc ($T_{\frac{1}{2}}$ = 2.8 h), ^{93m}Tc ($T_{\frac{1}{2}}$ = 44 min) and ^{93m}Mo ($T_{\frac{1}{2}}$ = 7 h) nuclei have been investigated by means of Ge(Li) and Si(Li) detectors. Accurate measurements of γ-ray energies and intensities have been performed, and 7 transition multipolarities, determined. Sixteen excited states of ^{93}Mo are established; 9 among them are new states. The half-lives of the 1477.15 keV and 2161.90 keV levels have been measured using the delayed coincidence technique, and were found to be <5 ps and 55 ± 8 ps, respectively. The results are compared with measurements obtained through nuclear reactions. (FR)

33896 OBSERVATION OF ^{92}Nb AND ^{94}Nb IN NATURE. Apt, K. E. (Los Alamos Scientific Lab., NM); Knight, J. D.; Camp, D. C.; Perkins, R. W. Geochim. Cosmochim. Acta; 38: No. 9, 1485-1488(Sep 1974).

Radioactivity measurements have shown evidence for long-lived ^{92}Nb and 2.03×10^4-yr ^{94}Nb in natural niobium. The specific activity of ^{94}Nb was observed to be 0.32 ± 0.03 dis/min. kg Nb and that of ^{92}Nb to be 0.058 ± 0.035 dis/min. kg Nb. With $t_{\frac{1}{2}}$ taken as ≈ 1.7×10^8 yr, the isotopic abundance of ^{92}Nb is 1.2×10^{-10} per cent. (auth)

33897 NUCLEAR DATA SHEETS FOR A = 103. Kocher, D. C. (Oak Ridge National Lab., TN). Nucl. Data Sheets; 13: No. 3, 337-395(Nov 1974).

The 1961 version of the Nuclear Data Sheets for A = 103 was revised on the basis of experimental data received prior to March 1, 1974. Information from approximately 150 papers and communications is included in the present evaluation. Data on nine A = 103 nuclei are presented. The compilers regard the assignment of fission-fragment γ rays to ^{103}Zr and ^{103}Nb as uncertain, and no measurements on the decay of these nuclei have been made. The half-lives of ^{103}Mo and ^{103}Cd are known, but no decay schemes have been proposed. The compilers propose a decay scheme for ^{103}Tc, based mainly on unpublished measurements, but further work is needed to determine absolute transition intensities and the decay energy. The decay schemes for ^{103}Ru, ^{103}Pd, and ^{103}Ag appear to be well established on the basis of extensive but mainly unpublished results. The spins of a few low-lying levels in ^{103}Ru are determined by single-nucleon-transfer reactions. Spin assignments have been made for most low-lying levels in the stable nucleus ^{103}Rh from ^{103}Ru decay, ^{103}Pd decay, and Coulomb excitation. The spins of many levels in ^{103}Pd have been determined from extensive unpublished results in ^{103}Ag decay, single-nucleon-transfer reactions, and in-beam γ-ray studies. Only one excited level is known in ^{103}Ag. For papers concerned with nuclear structure theory for A = 103 nuclei, see 66Sh18, 72Ku25, 73Bo16, and 73Im01. (auth)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 33864, 33877, 33885, 33894, 33921, 33924, and 33944.

33898 (JAERI-M-5624) NEUTRON TRANSMISSION AND SCATTERING MEASUREMENTS ON TUNGSTEN RESONANCES. Ohkubo, M. (Japan Atomic Energy Research Inst., Tokyo). Feb 1974. 22p. NTIS (US Sales Only).

Slow neutron resonances of natural tungsten were measured by transmission and scattering methods using the JAERI time-of-flight spectrometer with the maximum resolution of 2.5 ns/m.

Scattered neutrons from a sample were detected by a ^{6}Ni–^{7}Li pair glass scintillator, which compensated the capture-gamma-ray events; and the neutrons transmitted through the scattering sample were simultaneously measured by a ^{6}Li glass transmission detector. The efficiencies of the scattering and the transmission detectors were made to be equal for a wider energy region. Γ_n/Γ, normalized at a known resonance, were obtained from the ratio of scattering peak area, A_s, to the absorption dip area, A_t for each level. For about 40 levels below 1.4 keV, Γ_n/Γ and $g\Gamma_n^0/\Gamma$ were obtained. For the lower 10 resonances, parameters were obtained by the combination of the transmission and scattering data. For ^{183}W resonances above 120 eV, favorable spins for 9 levels were determined from $g\Gamma_n^0/\Gamma$ by us and $g\Gamma_n^0$ by others. Multiple scattering effects were calculated by the Monte-Carlo method for the 18.8 and 21.0 eV resonances. (auth)

33899 (JINR-P3-8004) MAGNETIC MOMENTS OF RESONANCE STATES OF DYSPROSIUM. Alfimenkov, V. P.; Vagov, V. A.; Zamrii, V. N.; Lason, L.; Mareev, Yu. D.; Ovchinnikov, O. N.; Pikel'ner, L. B.; Salai, Sh.; Sharapov, E. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1974. 16p. Dep. NTIS (U. S. Sales Only) $4.00.

Magnetic moments of neutron resonances in dysprosium were measured by the method of neutron transmission through a polarized target. The obtained values $m\vartheta$ (E_0, eV) in nuclear magnetons are the following: 2.8 ± 0.5 (1.71), −0.4 ± 0.7 (2.72), −1.8 ± 0.9 (3.69), and 0.5 ± 1.2 (4.35). (2 figures, 2 tables) (auth)

33900 (JINR-P4-7978) APPROXIMATION OF THE MOMENT OF INERTIA AS A FUNCTION OF ROTATIONAL BAND ENERGIES. Karadzhov, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 40p. (In Russian). Dep. NTIS (U. S. Sales Only) $5.00.

The moment of inertia of a deformed nucleus is approximated by a power expansion in rotational energy; in realistic cases a polynomial of the energy is employed. The coefficients of this polynomial were determined by solving an overdetermined problem for the description of the experimentally known energies in a rotational band. The condition number of the problem as a function of the maximal degree of the approximation polynomial is estimated. The numerical solution is performed by using a regularized Gauss–Newton-type process. The results obtained in the cases of second- and third-degree polynomial approximation are given. (7 figures, 3 tables) (auth)

33901 (JINR-P6-7997) DECAY OF ^{171}Lu AND LEVEL SCHEME OF ^{171}Yb. Bonch-Osmolovskaya, N. A.; Vylov, Ts.; Gromov, K. Ya.; Khamidov, A. Sh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Decay of ^{171}Lu was studied by methods of β and γ spectroscopy. The level scheme of ^{171}Yb was analyzed on the basis of new and more precise data on spectra of γ rays, conversion electrons, and positrons. Structure of excited states of ^{171}Yb was determined. (1 figure, 5 tables) (auth)

33902 (JINR-P7-8033) LIFETIMES OF THE ^{160}Yb ROTATIONAL LEVELS. Bochev, B.; Karamyan, S. A.; Kutsarova, T.; Subbotin, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The lifetimes of the 8 → 6, 6 → 4, 4 → 2 and 2 → 0 ground-band transitions in ^{160}Yb and feeding time for population of the band were measured by a recoil-distance Doppler-shift method following an (^{40}Ar,4n) reaction. Deviations in the deduced B(E2) values from rotational behavior are discussed. (4 figures, 1 table) (auth)

33903 (LBL-2904) PARITY NON-CONSERVING NUCLEAR FORCE. Chou, T. S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1974. Contract W-7405-eng-48. 118p. Dep. NTIS $9.00.

Thesis.

The effect of a parity-nonconserving nuclear force is studied in a deformed nucleus, ^{180m}Hf. The big nuclear structure factor of the 501-keV gamma transition in the decay of ^{180m}Hf enables one to observe a big asymmetry of 1.5% at an average temperature of 20 mK°. The nuclear structure factor can arise by various mechanisms; for example, a small energy spacing of the nuclear levels with opposite parity will cause a large mixing between them, and/or the parity-allowed transition (in this case, M2) has an anomalously small matrix element while the parity-forbidden transition (E2) is not hindered. The low temperature necessary for producing polarized nuclei is achieved by adiabatic demagnetization of a chromium potassium sulfate–glycerin slurry, which provides about 10 mK° heat sink. The ^{180m}Hf nucleus is polarized by a magnetic interaction of its dipole with the hyperfine field it sees in a cubic ferromagnetic compound, $ZrFe_2$, at low temperature. The asymmetry is defined as the intensity ratio of the intensity difference in 180° and 0° with respect to its nuclear polarization direction to its average value:

$$a = 2 \cdot \frac{W(180) - W(0)}{W(180) + W(0)} = 2 \cdot \frac{G_1B_1A_1 + G_3B_3A_3}{1 + G_2B_2A_2 + G_4B_4A_4}$$

where the G_k are determined from knowing the source–detector geometry; B_k are evaluated from the anisotropy of the 444-keV gamma transition in ^{180m}Hf; A_k are known from the transitions and the nuclear states involved; A_2 and A_4 are independent of parity mixing, and their values can be obtained from an angular correlation experiment; A_1 and A_3 are proportional to the parity-mixing ratio. Thus, by measuring the asymmetry of the 501-keV gamma transition, one can evaluate the parity-mixing ratio. By taking the slow warm-up of the sample into account, the parity-mixing ratio is derived to be 0.0290(19). (21 figures, 10 tables) (auth)

33904 (NP-20118, pp 38-40) SPIN–PARITY ASSIGNMENT AND E0 TRANSITIONS IN ^{156}Gd. Yamada, H. (Nagoya Univ., Japan); Katoh, T.; Sekikawa, M.; Fujioka, M.; Ahn, S. H. 19 Mar 1974.

33905 (NP-20118, p 115) PROTON-INDUCED REACTIONS OF ^{151}Eu. 19 Mar 1974.

33906 (USNDC-11, pp 25; 26) SCATTERING FROM HEAVY ROTATIONALLY-DEFORMED NUCLEI. Smith, A.; Guenther, P. (Argonne National Lab., IL). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33907 (USNDC-11, pp 35-41) DIRECT NEUTRON CAPTURE IN THE 4S GIANT RESONANCE: ^{164}Dy. Cole, G. W.; Chrien, R. E. (Brookhaven National Lab., Upton, NY). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33908 (USNDC-11, pp 55-58; 59) ^{186}W(n,γ)^{187}W REACTION AT 24 keV, HEXADECAPOLE DEFORMATIONS, AND FRAGMENTATION OF NILSSON STRENGTH. Casten, R. F.; Breitig, D.; Wasson, O. A.; Rimawi, K.; Chrien, R. E. (Brookhaven National Lab., Upton, NY). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33909 (USNDC-11, pp 65-67; 74-77; 81-91) NEUTRON RESONANCE SPECTROSCOPY ^{162,164}Dy. Liou, H. I.; Hacken, G.; Makofske, W.; Rainwater, J.; Singh, U. N. (Columbia Univ., New York). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33910 (USNDC-11, pp 176-178; 179-180) SPINS OF RESONANCES IN ^{175}Lu. Namenson, A. I.; Stolovy, A.; Smith, G. L. (Naval Research Lab., Washington, DC). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33911 (USNDC-11, pp 178; 181) RESONANCES IN ^{187}Os. Namenson, A. I.; Stolovy, A.; Smith, G. L. (Naval Research Lab., Washington, DC). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33912 COMPARISON OF IN-BEAM STUDIES OF ^{171}Hf LEVELS WITH RADIOACTIVE DECAY STUDIES OF ^{171}Ta. Ladenbauer-Bellis, I. M.; Rezanka, I. (Yale Univ., New Haven, Conn. (USA). Heavy Ion Accelerator Lab.). Atomkernenergie; 23: No. 4, 279-282(1974).

3 figs.; 3 tabs.; 12 refs.

Radioactive decay studies of ^{171}Ta were performed to establish the low energetic band head energies of the odd and even parity bands. For this purpose ^{171}Ta was produced via ^{165}Ho (^{12}C, 6n) ^{171}Ta and ^{159}Tb (^{16}O, 4n) ^{171}Ta reactions. The beam energies used were 80 MeV for the carbon ions and 93 MeV for the oxygen ions. A comparison of the in-beam data with the radioactive decay data showed that different levels are populated in these experiments. (auth)

33913 NUCLEI FROM THE REGION 52 = Z, N = 80 AS SUSCEPTIBLE TO THE GAMMA-DEFORMATIONS. Rohozinski, S. G.; Srebrny, J.; Horbaczewska, K. (Warsaw Univ. (Poland). Wydzial Fizyki). Z. Phys.; 268: No. 4, 401-408(Jul 1974).

3 figs.; 2 tabs.; 62 refs.

The applicability of the Wilets–Jean Hamiltonian including also a term giving small prolate-oblate asymmetry to transitional Xe, Ba, Ce isotopes is investigated. Energy levels and reduced probabilities of E2 and E0 transitions are calculated. The model reproduces fairly well the experimental data when using parameters far from those calculated microscopically. The results indicate that the wave functions have to be γ-localized more strongly than those given by the model. (auth)

33914 DESCRIPTION OF THE LOW-LYING NEGATIVE PARITY STATES IN ^{153}Gd. Tuurnala, T. (Helsinki Univ. (Finland). Dept. of Physics). Z. Phys.; 268: No. 4, 371-378(Jul 1974).

5 tabs.; 27 refs.

To explain the properties of the recently observed negative parity states in the 89-neutron nucleus ^{153}Gd, the Nilsson model is extended to include the Coriolis couplings between the $\frac{3}{2}^-[521]$, $\frac{5}{2}^-[523]$, $\frac{3}{2}^-[532]$, $\frac{1}{2}^-[530]$, $\frac{1}{2}^-[510]$, $\frac{1}{2}^-[521]$ and $\frac{5}{2}^-[512]$ bands. The calculation reproduces rather well the experimental level energies, single neutron transfer cross sections and electromagnetic transition rates. (auth)

33915 α-DECAY OF NEUTRON RESONANCES IN THE ^{149}Sm(n,α)^{146}Nd REACTION. Vinivarter, P.; Nedvedyuk, K.; Popov, Yu. P.; Rumi, R. F.; Salatskii, V. I.; Furman, V. I. Yadern. Fiz.; 20: No. 1, 3-9(Jul 1974). (In Russian).

The values of the total and partial α-widths of the neutron resonances of the ^{150}Sm nucleus, obtained from the ^{149}Sm(n,α)^{146}Nd reaction in the neutron energy range of 0.025 to 20 eV, are presented. The experimental results are compared with the predictions of the statistical α-decay model of highly excited states. The form of the E_0 = 0.87 eV resonance is described, taking into account the Doppler effect, as well as the interference between the resonances at 0.87 and 0.098 eV. (auth)

33916 STATES WITH $K^\pi = 1^+$ AND THEIR CONTRIBUTION TO ISOSCALAR E2 RESONANCE. Kuliev, A. A.; Pyatov, N. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 20: No. 2, 297-309(Aug 1974). (In Russian).

In framework of the random-phase approximation a unified treatment of the rotational branch of excitations and states with $K^\pi = 1^+$ is done without free parameters. The role of the 1^+ states in formation of the isoscalar E2 resonance in deformed nuclei is analyzed. The static effective charges for the E2 transitions are determined from the contribution of the rotational 2^+ level to the sum rule. Calculations of strength functions for the E2 transitions into the excitations with $I^\pi K = 2^+1$ and of energy distribution of their contribution to the energy-weighted sum rule indicate an existence of the E2 resonance (K = 1) in the energy interval 12.5 to 14 MeV in nuclei of the rare-earth region. Analogous calculations are carried out also for the M1 resonance situated in the energy interval 7 to 9 MeV. (auth)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 33823, 33831, 33846, 33870, 33874, 33885, 33894, 33900, 33924, and 33930.

33917 (CONF-740920-10) THRESHOLD PHOTONEUTRON SPECTRA. Jackson, H. E. (Argonne National Lab., Ill. (USA)). 1974. 20p. Dep. NTIS $4.00.

From 2nd international symposium on nuclear capture gamma-ray spectroscopy; Petten, Netherlands (2 Sep 1974).

Photoneutron spectra in the resolved resonance region near threshold are reviewed as a tool for the study of the neutron capture reaction mechanism. Recent measurements of the photodisintegration of the deuteron near threshold suggest discrepancies with the elementary model of the reaction. Data for nuclei in the mass region A ≈ 50 to 60 contain partial-width correlations and nonresonant reaction components characteristic of channel capture. Other nuclear structure effects in the form of intermediate structure and partial-width correlations for heavier nuclei are also discussed. Photon strength functions for E1 and M1 radiation resulting from measurement of threshold photoneutron spectra are compared with data from other sources and theoretical predictions. Intense p-wave photoneutron emission by the Pb isotopes indicates the presence of a magnetic dipole giant resonance whose integrated strength is close to the theoretical limit. (17 figures, 1 table) (auth)

33918 (COO-2186-19) NUCLEAR SPECTROSCOPY AND NUCLEAR REACTION WORK WITH (A) THE HEAVY ION ACCELERATOR, YALE UNIVERSITY AND (B) THE 4 MeV DYNAMITRON AT SUNY, ALBANY, NEW YORK. Technical Progress Report, December 1, 1973–July 31, 1974. Bakhru, H. (State Univ. of New York, Albany (USA)). Aug 1974. Contract AT(11-1)-2186. 36p. Dep. NTIS $5.00.

The studies of decay properties of several short-lived neutron deficient isotopes were conducted by using the Heavy Ion Accelerator at Yale. These studies are chosen to complement in-beam studies, furnishing energy-level data on the same nuclei. The lifetime studies on the excited states of several nuclei were completed. The argon and krypton beams from the SuperHILAC at Berkeley were utilized to study x-rays in heavy-ion collisions. The measurements of K-shell and L-shell ionization with fully stripped projectiles were carried out by using various heavy ions. Studies on millisecond isomers of the Pb, Os, and Ir region were conducted. The 4 MeV Dynamitron at SUNY/Albany was extensively used for α-capture studies on ^{35}Cl, ^{37}Cl, and ^{31}P. The heavy ions from the Dynamitron accelerator were used to conduct high-resolution studies of heavy-ion-induced x rays in the MeV region. (6 figures, 1 table) (auth)

33919 (COO-3122-8) HEAVY ION TRANSFER REACTIONS LEADING TO EXCITATION ENERGIES IN THE CONTINUUM. Miller, J. M. (Columbia Univ., New York (USA)). 7 Jun 1974. Contract AT(11-1)-3122. 22p. (CONF-740463-2). Dep. NTIS $4.25.

From meeting of the American Physical Society; Washington, District of Columbia, USA (22 Apr 1974).

With this type of reaction one studies the gross features of interactions between two chunks of nuclear matter. This paper discusses the angular momentum dependence of heavy-ion reactions, and sketches the current experimental and theoretical situation. The main features of the angular momentum dependence are illustrated with O + Au. The peak in the angular distribution for few-particle transfers vanishes for more complex transfer reactions. The relative yields of light transfer products and some possible systematics for the distribution of mass for products of a given charge are examined. Classical heavy-ion trajectories and their respective angular momenta are discussed from a theoretical viewpoint: what is sought is the probability that a given angular momentum in the entrance channel gives rise to a particular exit channel. The possibility that the primary transfer products are formed in excited states and hence that the transfer products observed experimentally, particularly the light ones, represent the evaporation residues from the primary transfer products is examined. (11 figures, 2 tables) (RWR)

33920 (INDC(CCP)-44/U, pp 55-66) STUDY OF PHOTONEUTRON REACTIONS CLOSE TO THE THRESHOLD. Abramov, A. I. Jul 1974.

The last few years have seen the development of a new method for studying the properties of atomic nuclei, based on the measurement of neutron spectra and photoneutron reaction cross sections close to threshold. A considerable improvement in the time-of-flight method employed for experiments of this kind has allowed for good enough energy resolution to obtain detailed information on the parameters of individual nuclear levels at excitation energies several hundred keV higher than the neutron binding energy. This paper reviews the data available on photonuclear reactions close to threshold and points out some of the possibilities for future application of the method. (auth)

33921 (NP-20118, pp 40-41) IN-BEAM γ-RAY STUDY OF EVEN Pt ISOTOPES. Numao, T. (Tokyo Inst. of Tech.); Yoshikawa, N.; Shida, Y.; Sakai, M. 19 Mar 1974.

33922 (NP-20118, pp 41-42) EVIDENCE FOR A $19/2^-$ ISOMERIC STATE IN ^{205}Po. Ohya, S. (Tokyo Univ.); Shida, Y.; Yoshikawa, N.; Numao, T. 19 Mar 1974.

33923 (USNDC-11, pp 267; 269-270) SMALL-ANGLE ELASTIC SCATTERING CROSS SECTIONS FOR Pb. Bucher, W.; Hollandsworth, C. E.; Youngblood, J. (Army Aberdeen Research and Development Center, MD). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33924 NUCLEAR STRUCTURE STUDIES OF THE TRANSITIONAL ISOTOPES ^{189}Os, ^{191}Os, AND ^{193}Os. Benson, D. Jr. Tallahassee, FL; Florida State Univ. (1974). 240p. University Microfilms Order No. 74-18,066.

Thesis (Ph. D.).

Energy levels in the transitional nuclei ^{189}Os, ^{191}Os, and ^{193}Os were studied in the following reactions: ^{188}Os(d,p)^{189}Os, ^{190}Os(d,t)^{189}Os, and ^{188}Os(n,γ)^{189}Os; ^{190}Os(d,p)^{191}Os, ^{192}Os(d,t)^{191}Os, and ^{190}Os(n,γ)^{191}Os; ^{192}Os(d,p)^{193}Os and ^{192}Os(n,γ)^{193}Os. The reaction energies were carefully measured. Level schemes were constructed. Insofar as possible, spins and parities were determined from charged-particle angular distributions and from gamma-ray deexcitation patterns. Many low-lying levels were assigned as Nilsson states, and some vibrational assignments were proposed. To a considerable extent, the assignments are based upon analogies with neighboring nuclei. Systematic trends in the transition region are discussed. Some possible evidence for triaxial symmetry is noted. (Diss. Abstr. Int., B)

33925 LOW LYING MULTIPLETS IN ^{210}Bi AND ^{210m}Bi CORE EXCITED STATES IN ^{209}Bi. Ponting, R. L. Tallahassee, FL; Florida State Univ. (1974). 288p. University Microfilms Order No. 74-18,083.

Thesis (Ph. D.).

The low-lying multiplet structure of ^{210}Bi was studied by using the direct reactions ^{209}Bi(d,p)^{210}Bi at incident deuteron energy 15 MeV, ^{209}Bi(t,d)^{210}Bi at incident triton energy 21 MeV, and the thermal-neutron-induced gamma rays resulting from bombardment of ^{209}Bi. Analysis of the direct reaction experiments using ratios of cross sections and DWBA analysis produced l transfer assignments and spectroscopic factors for 45 levels observed in these reactions up to 3300 keV excitation energy in ^{210}Bi. Analysis of the thermal-neutron-induced gamma spectrum of ^{210}Bi produced 58 levels below 2600 keV excitation with spin or spin range assignments based on dipole transitions and the well-known spins of states below 1000 keV excitation. Predictions of several studies based on the spherical shell model and perturbation calculation of the two-extracore-nucleon interaction were compared with the experimental results. Three-quasi-particle states in ^{209}Bi having ^{210m}Bi parentage were studied by means of the reaction ^{210m}Bi(d,t)-^{209}Bi at 17 MeV incident deuteron energy. Twenty-one levels were observed in the resulting triton spectrum, and the extracted angular distributions were analyzed by using DWBA calculations. l transfers and spectroscopic factors were extracted for each level by using a χ^2 fitting program, and the neutron hole state contributing to the configuration of the level was assigned through consideration of the energy centroid and spectroscopic strength of the single-neutron-hole states in ^{207}Pb. Shell-model calculations provided more usable information and described the splitting of the $\nu p_{\frac{1}{2}}^{-1}$ multiplet better than corresponding weak-coupling calculations. (RWR)

33926 MAGNETIC MOMENT OF THE NUCLEUS ^{209}Bi. Isakov, V. I.; Kharitonov, Yu. I.; Artamonov, S. A.; Sliv, L. A. (Leningrad Inst. of Nuclear Physics). Yadern. Fiz.; 20: No. 2, 283-296(Aug 1974). (In Russian).

Anomaly in the magnetic moment is calculated without using free parameters. Contribution to $\Delta\mu$ from the second-order terms is taken into account in contrast with other works. (auth)

33927 STUDY OF PHOTONUCLEAR REACTION PRODUCTS OF ^{197}Au FOR THE PURPOSE OF CONDUCTING GAMMA-ACTIVATION ANALYSIS OF GOLD. Azimov, S. A.; Iskanderova, M.; Miller, R. A.; Khakimov, M. (Tashkent State Univ.). Dokl. Akad. Nauk Uzb. SSR; No. 9, 12-13(1973). (In Russian).

Pure gold plates were irradiated in the betatron for 30 s with 25-MeV (max) bremsstrahlung at a dose rate of 800 R/min. Gamma spectra recorded 14 s after the end of the irradiation showed photopeaks suitable for identification and indicated the feasibility of gamma activation as a rapid method for identifying gold. The ^{195}Au isotope formed by the (γ,2n) reaction is the most suitable for use in the determination. (2 figures) (TTT)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 33499, 33789, 33864, 33871, 33874, 33885, and 33919.

33928 (AD-777842) GAMMA RADIATION FROM FISSION PRODUCTS. Drinkwater, R. B. (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio (USA). School of Engineering). Mar 1974. 56p. (GNE/PH-74-3). NTIS $6.00.

Thesis.

An analytical study was made to determine the gamma radiation produced by the products of a fission device. The radiation during times from .10s to 2 min after fission was of special interest. Fission yield data were gathered for 5 cases (fission-spectrum-irradiated ^{235}U, ^{236}U, and ^{239}Pu; and ^{235}U and ^{238}U bombarded by 14-MeV neutrons). Decay data were gathered for the fission products of these fuels. A computer program was written to process the data which produced quantitative energy and analysis. (auth)

33929 (CEA-N-1594) SEMI-ANNUAL PROGRESS REPORT NO. 2. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). 1972. 131p. (In French).

Work effected at the Grenoble Fundamental Research Department during the second half of 1972 in the following fields is briefly reviewed: nuclear physics (fission products, study of light nuclei using fast neutrons); physics of the condensate state (defects and radiation effects in solids); radiobiology. (FR)

33930 (COM-74-50459) MeV TOTAL NEUTRON CROSS SECTIONS. Final Monograph Report. Schwartz, R. B.; Schrack, R. A.; Heaton, H. Thompson II. (National Bureau of Standards, Washington, D. C. (USA)). Jan 1974. 259p. (NBS-MN-138). GPO $3.60.

The report is a compilation of the MeV neutron total cross section data measured at the National Bureau of Standards over the past several years. The measurements generally span the energy interval from 0.5 to 15 or 20 MeV; data are presented in graphical form for twelve normally occurring elements, plus the separated isotopes ^{235}U, ^{238}U, and ^{239}Pu. An appendix is included which gives complete details of the experimental technique. (GRA)

33931 (CONF-740903-7) PRESENT STATUS OF CROSS SECTION DATA OF THE FISSILE AND FERTILE ISOTOPES FOR FAST REACTORS. de Saussure, G.; Perez, R. B. (Oak Ridge National Lab., Tenn. (USA)). 1974. 21p. Dep. NTIS $4.25.

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974).

The status of the most relevant neutron cross sections for the design of fast breeder reactors is reviewed. (13 figures, 3 tables, 108 references) (auth)

33932 (DP-1311) TRANSPLUTONIUM CROSS SECTIONS DETERMINED IN A RESONANCE SPECTRUM IRRADIATION ASSEMBLY. Spencer, J. D.; MacMurdo, K. W. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Jul 1974. Contract AT(07-2)-1. 40p. Dep. NTIS $4.00.

The design and use of a lithium–aluminum mockup of a resonance neutron spectrum irradiation assembly is described. Five of these neutron filter assemblies, containing curium, californium, and reference foils of ^{235}U and ^{239}Pu, were irradiated in a Savannah River Plant reactor. The irradiation spectrum was similar to that of a reactor in which a large fraction of the D_2O moderator space is displaced with magnesium. Four of these capsules contained lithium–aluminum alloy, and one contained only aluminum to retain the nominal reactor spectrum. Irradiation products were chemically separated, and their concentrations were determined by chemical recovery and analytical techniques developed during this study. Burnup and production were calculated for each sample. Comparison of calculations with measurements indicated that the initial ^{244}Cm cross section was too high and the cross sections for ^{250}Cf, ^{251}Cf, and ^{252}Cf needed some adjustment. Recommendations for changes to these cross sections cannot be made because the method of creating a total effective cross section for the production calculations probably contains errors. Additional computations with effective cross sections derived from multigroup flux and cross section representation for samples irradiated in a variety of neutron spectra should permit more nearly quantitative recommendations for improvements in cross section data. (15 figures, 10 tables) (auth)

33933 (GSI-tr-73/18) ENERGY DEPENDENCE OF THE CROSS SECTIONS FOR FISSION AND NUCLEON TRANSFER IN THE REACTION OF ^{232}Th WITH ACCELERATED ^{74}Ge IONS. Nadkarni, D. M. (Bhabha Atomic Research Centre, Bombay); Oganesyan, Yu. Ts.; Nguyen, T. A.; Penionzhkevich, Y. E.; Pustyl'nik, B. I. Oct 1973. Translated from the original by W. Sey. 10p. (In German).

An abstract of this paper, prepared from the original language, appeared as NSA 29: 3989. (RWR)

33934 (GSI-tr-74/16) EXPERIMENTS CONCERNING THE SEARCH OF SPONTANEOUS FISSION NUCLIDES OF SUPER-HEAVY ELEMENTS IN NATURE. P. 2. Search for the Heavy Homologue of Lead in Lead Ores and Minerals. Flerov, G. N.; Ter-Akop'yan G. M.; Getskin, L. S.; Goncharov, G. N.; Popeko, A. G.; Skobolev, N. K.; Gvozdev, B. A.; Tsyb, P. P. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Jun 1974. 9p. (In German). INIS.

1 fig.; 3 tabs.; 15 refs. With abstract. Translation of the Russian report JINR-P-6-7759. Available from ZAED.

The search for spontaneous fission of heavy homologues of lead (element 114) in various minerals was carried out by means of large proportional counters and neutron detectors. In a few lead ores a possible weak effect of spontaneous fission was observed. Mechanical and chemical concentration methods however, yielded no positive results. Assuming the half-life of the superheavy element searched for to be 10^9 years, its content in the samples investigated did not exceed 10^{-13}–10^{-15} g/g. (GE)

33935 (IFA-NR-51-1974) MULTILEVEL CALCULATION OF ^{235}U NEUTRON CROSS SECTION FOR MANY FISSION CHANNELS. Cirstoiu, F.; Mihailescu, I. M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

Under the assumption of a limited number of levels and an arbitrary number of fission channels, the ^{235}U neutron fission

cross section was obtained. For each resonance level a fission vector was introduced, the number of its components being equal to the number of the open fission channels. The interference between the resonance levels, of the same spin and parity, was taken into account by means of the angle of the fission width vector $\vec{\Gamma}_{kF}$, relative to the lowest-lying level. By using a FORTRAN IV program, the ^{235}U fission cross section values were computed for neutron energies less than 2 eV. Two figures illustrate the fit of the ^{235}U fission cross-section computed curve to the experimental data from the literature and from this laboratory. (2 figures, 2 tables) (auth)

33936 (IFA-NR-52-1974) MULTILEVEL-MULTICHANNEL CALCULATION OF THE ^{235}U NEUTRON FISSION CROSS SECTION. Mihailescu, I. M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

The multilevel-multichannel neutron fission cross section is given in terms of Kapur-Peierls poles, μ_k and ν_k, and residues, $G_k^{(F)}$ and $H_k^{(F)}$. The fission cross section expression has a simple form, being a sum of single-level terms with interference. The multilevel-multichannel resonance parameters μ_k, ν_k, $G_k^{(F)}$, and $H_k^{(F)}$ have complicated expressions, but slow energy dependence, and they can be treated as constants over the resonance line k. The presence of the terms $H_k^{(F)}$ (μ_k-E) introduces the asymmetry in the fission cross-section curve, which is shown in the measurements. By means of a perturbation method the multilevel-multichannel resonance parameters are obtained from the R-matrix resonance parameters. By using a FORTRAN IV program, the multilevel-multichannel parameters and the ^{235}U fission cross-section values are computed. A figure shows the agreement between the ^{235}U fission cross-section values computed for neutron energies less than 2 eV with the multilevel-multichannel formalism and those obtained previously, by using a Vogt formalism. (1 figure, 3 tables) (auth)

33937 (INDC(CCP)-44/U) COMPENDIUM OF SELECTED TRANSLATIONS OF SOVIET REPORTS ON NUCLEAR DATA. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jul 1974. 56p. (CONF-730538-7; CONF-730538-8). Dep. NTIS (US Sales Only) $6.00.

From national Soviet conference on neutron physics; Kiev, USSR (28 May 1973).

Each of the five translations in this report was processed separately for NSA. (RWR)

For abstracts of individual papers see: 33920 and 33938-33941.

33938 (INDC(CCP)-44/U, pp 1-25) EVALUATION OF NUCLEAR CONSTANTS FOR ^{239}Pu IN THE NEUTRON ENERGY RANGE 10^{-5} eV TO 15 MeV. Konshin, V. A.; Antsipov, G. V.; Bakhanovich, L. A.; Morogovskii, G. B.; Sukhovitskii, Ya. Sh. Jul 1974.

From All-Union conference on neutron physics; Kiev, USSR (May 1973).

A brief description of the results of evaluating nuclear constants for ^{239}Pu in the energy range 10^{-5} eV to 15 MeV is given. In the thermal energy range (10^{-5} to 1 eV) the authors analyze existing experimental data for σ_a, σ_f, α, and η, evaluate these values, and compare the values of η obtained by the direct method as well as from the cross-section ratio. In the resonance energy range the authors propose a multilevel formalism allowing for interference, develop and run a program on the "Minsk-22" computer, and analyze simultaneously three types of cross-sections σ_a, σ_f, and σ_c. In the unresolved-resonance energy range an algorithm is developed, and the corresponding parameters for describing the cross-sections are derived. An evaluation is performed of the total cross-section, the fission cross-section, the value $\bar{\nu}$, and the value α, along with an analysis of existing experimental data. The neutron inelastic scattering cross section is calculated from a statistical nuclear model. A model is developed for calculating the cross sections of the reactions (n,2n) and (n,3n). The angular distributions of elastically scattered neutrons are expanded in terms of Legendre polynomials. (auth)

33939 (INDC(CCP)-44/U, pp 27-36) MEASUREMENT OF ALPHA FOR ^{239}Pu IN THE 3 TO 200 keV ENERGY RANGE. Vorotnikov, P. E.; Vukolov, V. A.; Koltypin, E. A.; Molchanov, Yu. D.; Yankov, G. B. (Inst. of Atomic Energy, Moscow). Jul 1974.

From All-Union conference on neutron physics, Kiev, USSR (May 1973).

The energy dependence of the capture-to-fission ratio for ^{239}Pu was measured in the neutron energy range from 3 to 200 keV. The work was performed on a pulsed electrostatic accelerator. The neutron energy was determined by the time-of-flight method. The capture gamma rays as well as the fission gamma rays and neutrons were recorded with stilbene detectors. The results obtained are presented in a table. (auth)

33940 (INDC(CCP)-44/U, pp 37-44) URANIUM-238 NEUTRON DATA EVALUATED FOR THE SOKRATOR LIBRARY. Abagyan, L. P.; Bazazyants, N. O.; Gorbacheva, L. V.; Zabrodskaya, A. S.; Korchagina, Zh. A.; Nikolaev, M. N.; Petrova, L. V.; Sinitsa, V. V. (Inst. of Physics and Power Engineering, Obninsk, USSR). Jul 1974.

The evaluated uranium-238 neutron data have now been put into the SOKRATOR library format. The ^{238}U file contains 42 sections, giving data for 14 reactions in the range 0.001 eV to 15 MeV (cross-sections, angular and energy distributions). A short description of the evaluation is given. (1 figure) (auth)

33941 (INDC(CCP)-44/U, pp 45-53) EVALUATION OF GROUP CROSS-SECTIONS FOR PLUTONIUM-238, AMERICIUM-243, AND CURIUM-244. Abagyan, L. P.; Dovbenko, A. G.; Zakharova, S. M.; Kapustina, V. F.; Nikolaev, M. N.; Petrova, L. V. Jul 1974.

33942 (UCID-15755) STATUS REPORT TO NCSAC. Bowman, C. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 13 Nov 1970. 18p. Dep. NTIS $4.00.

This status report, dated November 13, 1970, is divided into three sections. It contains the following items: New facilities (100-MeV Livermore Electron Accelerator Facility, Cyclograaff Facility), Neutron physics (detection of symmetric division in spontaneous and thermal-neutron-induced fission of ^{257}Fm, thermal-neutron fission cross section of ^{257}Fm, the transport of 14-MeV neutrons through Fe, threshold photoneutron cross section measurements, evaluations of neutron cross sections), and Activation analysis (detection of Pb(γ,n) by activation analysis). (RWR)

33943 (UCID-16514(Add.)) ADDENDUM TO USNDC STATUS REPORT. Anderson, J. D.; Browne, J. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Sep 1974. Contract W-7405-eng-48. 4p. Dep. NTIS $4.00.

This addendum to the LLL status report to the USNDC updates information concerning the ^{235}U fission cross-section measurements and the fission cross-section ratio measurements currently being performed at the LLL linac. Abstracts from reports UCRL-76041 and UCID-16548 are given. (RWR)

33944 (USNDC-11, pp 28; 30) NUCLEAR RAMAN SCATTERING OF 11.4 MeV PHOTONS BY ^{238}U, ^{232}Th, AND ^{159}Tb. Jackson, H. E.; Thomas, G. E.; Wetzel, K. J. (Argonne National Lab., IL). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33945 (USNDC-11, pp 31-33) FISSION ISOMERISM. Wolf, K. L.; Meadows, J. W. (Argonne National Lab., IL). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33946 (USNDC-11, p 34) SPECIFIC ACTIVITY AND HALF-LIFE OF ^{233}U. Flynn, K. F.; Bentley, W. C.; Karttunen, J. O. (Argonne National Lab., IL). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33947 (USNDC-11, pp 71-72; 103-107) PULSE HEIGHT DISTRIBUTIONS IN FISSILE NUCLEI. Felvinci, J. P.; Melkonian, E. (Columbia Univ., New York). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33948 (USNDC-11, pp 121-130) ISOMERIC GAMMA RAYS FROM ^{238}U(n,f) AND ^{239}Pu(n,f) FOR TIMES LESS THAN ONE MICROSECOND AFTER FISSION. Verbinski, V. V.; Sund, R. E.; Weber, H. (Intelcom Rad Tech, San Diego, CA).

In reports to the U. S. Nuclear Data Committee.

33949 (USNDC-11, pp 131; 132) ^{235}U FISSION CROSS-SECTION MEASUREMENT. Czirr, J. B.; Sidhu, G. S. (Univ. of California, Livermore). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33950 (USNDC-11, pp 155-159) SPECTRUM OF DELAYED NEUTRONS FROM FAST FISSION OF ^{235}U. Evans, A. E.; East, L. V. (Los Alamos Scientific Lab., NM). Jun 1974.

In reports to the U. S. Nuclear Data Committee.

33951 (UUIP-834) PERTURBED ALPHA-GAMMA ANGULAR CORRELATION STUDIES OF RADON RECOILS INTO ALUMINIUM. Orre, B.; Norlin, L. O.; Falk, F.; Johansson, K.; Noreland, T.; Arnesen, A. (Uppsala Univ. (Sweden). Fysiska Institutionen). Dec 1973. 12p. Dep. NTIS (US Sales Only) $4.00.

The quadrupole interaction of ^{222}Rn and ^{220}Rn implanted by α-decay in Al metal and Al oxide has been investigated. The experimental results indicate an electrical interaction in cubic Al metal not in agreement with earlier measurements using isotope implanted sources. (auth)

33952 CROSS-SECTION MEASUREMENT OF PLUTONIUM-236 FORMATION IN PLUTONIUM-238 BY ^{237}Np(n,2n) REAC-

TIONS. Paulson, C. K.; Hennelly, E. J. (Du Pont de Nemours and Co., Aiken, SC). Nucl. Sci. Eng.; 55: No. 1, 24-27(Sep 1974).

High-energy neutron cross sections for ^{237}Np are needed to calculate unwanted ^{236}Pu contaminant in ^{238}Pu product made for heat source applications in space and medical projects. Recent improved determination of ^{236}Pu formation by $^{237}Np(n,2n)$ reactions completes the information needed to calculate $^{236}Pu/^{238}Pu$ ratios over a wide range of ^{237}Np irradiation environments, from D_2O reflectors to pressurized-water-reactor fuel. The $^{237}Np(n,2n)-^{236s}Np$ cross section is 63 ± 6 mb, averaged over the ^{235}U fission spectrum >6.8 MeV; this result is consistent with the cross section calculated by Pearlstein [Nucl. Sci. Eng., 23: 238(1965)]. (5 tables) (auth)

33953 SPECTRUM OF DELAYED NEUTRONS FROM THE THERMAL-NEUTRON FISSION OF URANIUM-235. Sloan, W. R.; Woodruff, G. L. (Univ. of Washington, Seattle). Nucl. Sci. Eng.; 55: No. 1, 28-40(Sep 1974).

Measurements of the spectra of delayed neutrons from the thermal fission of ^{235}U are reported over the energy range 30 to 1500 keV. The resolution is sufficient to identify locations of peaks in the spectra. Spectra for three different count-irradiation cycles are reported with the shortest representing a near equilibrium spectrum for delayed neutrons from ^{235}U. Comparisons with existing data show relatively good agreement to the spectral peaks. A correction for the shield of the detector is introduced and applied to the current and previous work with reasonable results. In general, the new spectra are softer than previously reported and show more detailed structure. (11 figures, 6 tables) (auth)

33954 POSSIBLE EXISTENCE OF VERY HEAVY NEUTRON NUCLEI. Antonchenko, V. Ya.; Bragin, V. N.; Simenog, I. V. (Inst. of Theoretical Physics, Kiev). JETP Lett. (USSR) (Engl. Transl.); 19: No. 9, 314-315(5 May 1974).

Translated from Zh. Eksp. Theor. Fiz., Pis'ma Red.; 19: No. 9, 606-608(5 May 1974).

It is found on the basis of several calculation methods that systems of multineutrons with nonsaturating NN forces form bound states with $N > N_{cr}$ particles, where N_{cr} lies in the approximate range 10^2 to 10^3 particles, depending on the type of interaction. (auth)

33955 RENAISSANCE OF X-RAY SPECTROSCOPY IN HEAVY-ION PHYSICS. Soff, G.; Greiner, W. (Frankfurt Univ. (F.R. Germany). Inst. fuer Theoretische Physik). Phys. Bl.; 30: No. 8, 345-356(Aug 1974). (In German).

6 Figs.; 22 Refs.

New perspectives have been opened up recently in heavy-ion physics by the possibility of producing short-time quasimolecular systems in the heavy-ion collision with a net charge Z of both nuclei much larger than 105 (Hahnium, the heaviest element so far). This artificially enhanced central charge has far-reaching consequences, first for the study of quasiatomic (or rather: molecular) intermediate systems, further for testing the quantum electrodynamics in very strong external fields, and for the verification of the (neutral) physical vacuum. Some of these studies are feasible already now and the experimental possibilities will be greatly improved by the availability of heavy-ion accelerators so that one can speak of a renaissance of x-ray spectroscopy—last but not least due to the considerably improved measuring accuracy. The theoretical motivations and the first experimental results in this field are discussed. (GE)

33956 SEARCH FOR AND SYNTHESIS OF SUPERHEAVY ELEMENTS. Stephan, C. (Paris Univ., Orsay, France). J. Phys. (Paris), Colloq.; No. 4, 5-11(1973). (In French).

From centenary congress of the French Physical Society; Vittel, France (28 May 1973).

A short review of theoretical results concerning the existence of an island of stability is presented, showing essentially the very long half-lives of superheavy elements deduced from most calculations. Different experimental ways for the synthesis of these elements are described, and the negative results obtained up to now are discussed. The theory of a possible nucleosynthesis of superheavy nuclei is presented. The methods investigated for the search of such elements in nature are described, and the nonconclusive results obtained are given. (FR)

33957 MEASUREMENTS OF α-VALUES FOR ^{239}Pu IN FILTERED REACTOR BEAMS OF NEUTRONS. Dvukhsherstnov, V. G.; Kazanskii, Yu. A.; Furmanov, V. M.; Petrov, V. L. At. Energ. (USSR); 37: No. 2, 131-134(Aug 1974). (In Russian).

Measurements of $\alpha = \sigma_c/\sigma_f$ for ^{239}Pu in filtered reactor beams of neutrons having energies of 2, 24.5, and 140 keV and the "soft" spectrum of neutrons were performed. The values of α obtained in this work are compared with data of differential measurements, estimated data, and calculations. (3 figures, 3 tables). (auth)

33958 PROMPT-NEUTRON YIELD FROM THE SPONTANEOUS FISSION OF ^{252}Cf. Boldeman, J. W. (Australian Atomic Energy Commission, Lucas Heights, Australia). Nucl. Sci. Eng.; 55: No. 2, 188-202(Oct 1974).

An absolute measurement was made of the average number of prompt neutrons emitted per fission, $\bar{\nu}_p$, in the spontaneous fission of ^{252}Cf by using the liquid scintillator method. A value of 3.738 ± 0.015 was obtained. (6 figures, 7 tables) (auth)

33959 MEASUREMENT OF THE FISSION CROSS SECTION OF ^{235}U FOR INCIDENT NEUTRONS WITH ENERGIES BETWEEN 2 AND 100 KEV. Perez, R. B.; de Saussure, G.; Silver, E. G.; Ingle, R. W.; Weaver, H. (Oak Ridge National Lab., TN). Nucl. Sci. Eng.; 55: No. 2, 203-218(Oct 1974).

The fission cross section of ^{235}U was measured for incident-neutron energies between 2 and 100 keV by using an electron LINAC pulsed source of neutrons and the time-of-flight technique. The fission events were characterized by coincidence between the pulses of a fission chamber, placed at the center of a large scintillation tank, and gamma-ray events registered in the tank. The incident-neutron spectrum versus energy was monitored by a BF_3 ionization chamber and checked with a ^6Li-glass neutron detector. The cross sections were normalized to a value of 31 643 b–eV for the fission integral between 2 and 10 keV. Comparison of the present ^{235}U fission cross-section results with the values from other sources shows that, in general, there is an agreement within 3 to 5% in the energy region covered by this experiment. The previously reported intermediate structure in the fission cross section in the keV region was confirmed by the results of this work. (13 figures, 11 tables) (auth)

33960 FINE STRUCTURE OF ENERGY SPECTRA OF FRAGMENTS FROM SPONTANEOUS FISSION OF ^{252}Cf. Baranov, I. A.; Tutin, G. A. Yadern. Fiz.; 20: No. 2, 266-269(Aug 1974). (In Russian).

The fine structure of the energy spectra of fragments from ^{252}Cf spontaneous fission is studied. The existence of such structure at fixed energy of the light fragment is shown with sufficient confidence level at very high energy values (116.5 to 124 MeV). The structure has a periodicity ~5 a.m.u. (auth)

Nuclear Theory

Refer also to abstracts 33170, 33197, 33198, 33383, 33384, 33386–33388, 33822, 33888, and 33919.

33961 (CONF-730618-, pp 102-127) TRENDS IN THE STUDY OF NUCLEI AWAY FROM STABILITY. Hansen, P. G. (CERN, Geneva). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Examples are given of experimental work concerning the properties of nuclei far from the region of stability. Most of the examples are selected from the experiments being carried out by the ISOLDE collaboration at CERN. Topics discussed are: nuclear masses; nuclear spins, moments and sizes; alpha and proton radioactivity; beta and gamma radioactivity; beta-delayed particle emission; and beta strength functions and fluctuation phenomena. (BRH)

33962 (COO-3001-77) INTERFERENCE EFFECTS BETWEEN COULOMB AND NUCLEAR PROCESSES. Broglia, R. A. (State Univ. of New York, Stony Brook (USA). Dept. of Physics). 1974. Contract AT(11-1)-3001. 24p. (CONF-740637-9). Dep. NTIS $4.25.

From international conference on reactions between complex nuclei; Nashville, Tennessee, USA (10 Jun 1974).

The topic of interference effects between Coulomb and nuclear processes is reviewed. Elastic and inelastic scattering reactions among heavy ions display angular distributions with very distinctive oscillatory structure; a complete and simple description of these reactions is obtained in terms of a semiclassical theory of the reaction mechanism, based on the phenomenon of Coulomb–nuclear interference. This result requires the existence of a strong nuclear ion–ion potential; it also provides direct evidence for the quantitative importance of multistep processes in heavy-ion reactions. From the point of view of nuclear spectroscopy the Coulomb–nuclear interference phenomenon is shown to be a potentially powerful method for measuring the static quadrupole moments of excited states. The topic is treated under the following headings: the semiclassical approximation, semiclassical treatment of absorption, the ion–ion potential, inelastic form factors, first- and second-order excitations, and interference phenomena. The reaction Ni + O is used for illustrative purposes. The following points may be noted: wiggles in elastic scattering are predicted, as well as the 180° phase rule for inelastic scattering; semiclassical and quantum calculations agree fairly well; and this method can be used to determine Q values. (12 figures) (RWR)

33963 (COO-3463-16) NEUTRON AND GAMMA EMISSION FROM HIGHLY EXCITED STATES AND STATES WITH HIGH SPIN. Annual Progress Report. Sperber, D. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA)). Aug 1974. Contract AT(11-1)-3463. 16p. Dep. NTIS $4.00.

Attention was focused on the theoretical study of the interaction between heavy ions above the Coulomb barrier for a wide range of projectile masses and energies. The following topics were investigated: the development of a classical model with frictional or dissipative forces for the interaction between heavy ions; the application of the model to the evaluation of the critical angular momentum, l_{cr}, or the cross section for complete fusion, σ_{cf}; the application of the model to the study of the angular distribution in deep inelastic processes; the energy losses in deep inelastic processes; the mass transfer in deep inelastic processes; the validity of the sharp-cut-off approximation, which is used to extract the value of l_{cr} from the experimentally measured values of σ_{cf}; and the isomer ratios for shape isomers in heavy-ion reactions. The experimental situation is also briefly described. (1 figure) (RWR)

33964 (GSI-72-7) HEAVY ION SEMINAR GSI: WS 1970/71 AND SS 1971. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Jul 1972. 286p. (In German).

This report on the third and the fourth heavy-ion seminars contains the following 10 lectures: heavy nuclei in cosmic radiation; neutron deficient even-even isotopes of Kr, Se, Ge and the pseudo-SU(3) coupling; deformation reactions and Coulomb fission; Coulomb excitation (theory); Coulomb excitation (experiments); ion sources for the acceleration of heavy ions; inner-shell ionization in heavy-ion collisions; two-center shell model and its application to nuclear fission and heavy-ion scattering; proposal for an rf separator for heavy reaction products; collective potential surfaces and the spectra of nuclei. (GE)

33965 (KHFTI-73-10, pp 84-87) DIFFRACTION SCATTERING IN THREE-PARTICLE SYSTEM. Polozov, A. D. (Inst. of Theoretical Physics, Kiev). 1973. (In Russian).

On the basis of the Faddeev equation, formulas were obtained for the amplitudes of the elastic scattering in three-particle systems in the diffraction approximation. In the framework of this approximation the interaction between bound states of nuclei is taken into consideration. The errors connected with the deviation from the geometric optics and with consideration of the relative movement of nuclear particles were determined. (INIS)

33966 (ORO-4119-4) THEORETICAL RESEARCH OF NUCLEAR PHYSICS. Progress Report. Liu, K. H. (Southern Univ., Baton Rouge, La. (USA). Dept. of Physics). 1974. Contract AT(40-1)-4119. 9p. Dep. NTIS $4.00.

Effort was concentrated on developing a new, simple, and accurate method to evaluate the 6-fold stripping amplitude integral in the zero-range theory of deuteron stripping reactions. (RWR)

33967 ON THE STRUCTURE OF THE ATOMIC NUCLEI. Lezuo, K. J. (Mainz Univ. (F. R. Germany). Inst. fuer Kernphysik). Atomkernenergie; 23: No. 4, 285-290(1974).

4 figs.; 16 refs.

A new theory of the structure of the atomic nuclei is proposed and is shown to be supported by experimental evidence. It assumes the relevance of the geometrical structure of close-packed spheres and leads to the introduction of the concept of the local α-particle. This, like the true α-particle, has nucleons associated with the four corners of a tetrahedron. Well-defined surface conditions in conjunction with the Pauli principle allow for the prediction of magic numbers. It has been found meaningful to subdivide the nuclei into two major series. The first series which embodies the nuclei which have roughly equal numbers of protons and neutrons is studied explicitly and is traced up to the thorium isotopes. (auth)

33968 DETAILED STUDY OF THE FATE OF THE ISOTOPIC (σ_n) CORRELATIONS IN POSSIBLE S-PROCESS CONDITIONS. Arnould, M. (Brussels Univ. (Belgium). Institut d'Astronomie et d'Astrophysique). Astron. Astrophys.; 31: No. 4, 371-380 (Apr 1974).

4 figs.; 1 tab.; 39 refs.

As a continuation of a previous paper (Arnould, 1972) which was concerned with the establishment of limitations either on the time possibly spent by s-nuclides in the neutron depleted parts of C-O and Ne-O regions, or on the maximum fraction of the solar system s-elements which might come directly from those layers, the present work examines the restrictions which could be put on the physical conditions which have possibly prevailed during the s-process(es) responsible for the solar system s-elements synthesis, and particularly on typical mean neutron irradiations. When electron captures and β-decays are properly taken into account in the s-process model, it appears in particular that the isotopic (σ_n) correlations for Te could be destroyed to such an extent that observable consequences could arise for a range of mean neutron densities which becomes wider and wider as temperatures and densities increase. (auth)

33969 HALF-LIFE AND ELECTRONIC SHELL. Keller, C. Nachr. Chem. Tech.; 21: No. 24, 542-544(Dec 1973). (In German).

2 figs.; 1 tab.

The half-life of a radionuclide, the electron capture, e.g. of beryllium 7, the isomeric transition (examples: ^{99m}Tc, ^{93m}Nb), and α- and β-decay are reviewed. (GE)

33970 GAMMA VIBRATIONS AND THE STRUCTURE OF THE NUCLEAR FERMI SURFACE. Hernandez, E. S. (Buenos Aires Univ. Nacional (Argentina). Departamento de Fisica); Plastino, A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik). Z. Phys.; 268: No. 3, 337-346(Jun 1974).

6 figs.; 22 refs.

The correlated ground state of deformed heavy nuclei is examined with relation to the $K^\pi = 2^+$ excited states predicted by the Quasi Particle Random Phase Approximation. Both the schematic and the nonschematic treatments of residual interaction are considered. The quasi particle density distribution over the available orbitals is analyzed for nuclei within the rare earth region. Relations between the quasi particle density matrix and one-nucleon-transfer amplitudes are derived and the reaction probabilities are studied as functions of the energy. It is found that a consistent description of nuclear ground state correlations (within the spirit of the quasi boson approximation) is obtained both with the schematic and nonschematic treatments. Effects of the presence of different matrix elements of the residual interaction are discussed. (auth)

33971 MICROSCOPIC THEORY OF NUCLEAR REACTIONS FOR A MULTI-PARTICLE-BREAK-UP. Grauel, A. (Frankfurt Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Z. Naturforsch., a; 29: No. 6, 859-866(Jun 1974). (In German).

1 fig.; 14 refs.

Introducing correlated continuum wave functions for the two- and n-particle-continuum a microscopic theory of nuclear reactions based on a method of Fano is developed. The S-matrix-elements are given by the matrix-elements between correlated continuum wave functions and bound state wave functions. The antisymmetrization of the continuum wave functions with more than one particle in the continuum is included. The theory can be straightforwardly applied to the n-nucleon-emission process following photo- and particle excitations. (auth)

33972 THREE AND FOUR CENTRE OSCILLATORS AND THEIR APPLICATION IN NUCLEAR PHYSICS. Bergmann, P.; Scheefer, H. J. (Frankfurt Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Z. Naturforsch., a; 29: No. 7, 1003-1010 (Jul 1974).

9 figs.; 12 refs.

The extension of the nuclear two-centre-oscillator to three and four centres is investigated. Some special symmetry-properties are required. In two cases an analytical solution of the Schroedinger equation is possible. A numerical procedure is developed which enables the diagonalization of the Hamiltonian in a non-orthogonal basis without applying Schmidt's method of orthonormalization. This is important for calculations of arbitrary two-dimensional arrangements of the centres. (auth)

33973 THREE-BODY DYNAMICS AND CHANNEL DISTORTIONS IN DIRECT NUCLEAR REACTIONS. Anni, R. (Univ., Lecce, Italy); Taffara, L.; Vanzani, V. Nuovo Cim., A; 23A: No. 3, 431-446(1 Oct 1974).

Starting from an exact three-body formulation of nuclear rearrangement, inelastic and break-up processes, an operator reduction procedure of the three-body equations is developed, by which the components from implicit channels -channels different from the initial and final ones- are formally eliminated. This procedure allows us to introduce in a simple way a distorted-wave approximation scheme involving generalized transition potentials, which take account also of contributions from the implicit channels. In order to facilitate the comparison between this approximation scheme and the DWBA, the former one is recast in an alternative form, in which the DWBA contributions appear explicitly separated from the additional ones. The importance of these latter contributions is discussed. As far as rearrangement processes are concerned, it is shown that the polar- and triangular-diagram mechanism contributions -contained in the generalized transition potential- sum up to give, in interesting practical cases, the DWBA. (auth)

33974 DEPENDENCE OF THE ENERGY OF NUCLEAR MATTER ON SPIN AND ISOSPIN EXCESS. Dabrowski, J. (Inst. for Nuclear Research, Warsaw). pp 585-604 of Nuclear

Many-Body Problem. Vol. II. Calogero, F. (ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33975 THEORY OF RADIATIVE WIDTH (HIGHLY EXCITED NUCLEI). Nosov, V. G.; Kamchatnov, A. M. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 2, 441-452 (Aug 1974). (In Russian).

A microscopic theory of electromagnetic radiation by highly excited nuclei is developed on basis of the Landau theory of a Fermi fluid. Closed formulas for the mean radiative width and its mean square fluctuation from one level to another are obtained. Temperatures of various nuclei are calculated by using the observed widths. The relaxation time (for transition to an equilibrium state) is estimated by employing the experimental data on radiative width fluctuations. Regions of various types of relations between the relaxation time and lifetime of the compound nucleus are discussed as well as the relevant physical consequences. (auth)

33976 INTRINSIC STATES OF THE DEFORMED NUCLEI. Poenaru, D. N. (Institutul de Fizica Atomica, Bucharest). Stud. Cercet. Fiz.; 25: No. 1, 83-106(1973). (In Rumanian).

After a two-page introduction, the Hamiltonian of the system is discussed and some diagonalization examples are given. Then the use of the other representation is considered. The high deformation limit and asymptotic solutions are treated. The energy level diagram is presented, and then the total energy of the nucleus and its equilibrium deformation are studied. Finally, the generalized Nilsson model is described. (7 figures, 3 tables) (RWR)

33977 CLASSIFICATION OF WAVE FUNCTIONS IN A MULTI-NUCLEON SYSTEM BY A ROTATION GROUP METHOD. Jen, K. W. Wu Li Hsueh Pao; 23: No. 3, 165-177(May 1974).

A projection operator method is given which is used to classify wave functions in a multi-nucleon system. Also the results of the classification coefficients for A = 1 to 3 are given. (auth)

33978 MECHANISM OF TERNARY NUCLEAR FISSION. Gol'danskii, V. I.; Dalidchuk, F. I. (Inst. of Chemical Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 19: No. 9, 312-314 (5 May 1974).

Translated from Zh. Eksp. Theor. Fiz., Pis'ma Red.; 19: No. 9, 603-606(5 May 1974).

A new mechanism of ternary fission is proposed, with removal of a long-range charged particle. This mechanism is connected with the emergence of the corresponding single-particle energy levels to the continuous-spectrum band. The charged-particle spectrum is calculated, and its dependence on the energy of the internal excitation of the fissioning nucleus, on the mass of the third particle, and on its emission direction is analyzed. Many known experimental facts find a natural explanation within the framework of the proposed mechanism. (auth)

33979 BASIS FUNCTIONS FOR INVESTIGATION OF COLLECTIVE MOTION IN NUCLEI. Perkauskas, D. Ch.; Petrauskas, A. K.; Sabalyauskas, L. Yu. (Inst. of Physics and Mathematics, Vilnyus, USSR). Teor. Mat. Fiz.; 20: No. 2, 274-281(Aug 1974). (In Russian).

General solution of the Schroedinger equation for many-dimensional oscillator in terms of collective variables is obtained, and with the aid of this solution the method of constructing the complete basis in the collective variables for the decomposition of the nucleus wave function is developed. The calculation of the matrix elements is considered, and the symmetry of the basis functions under transformations of the intrinsic axes is discussed. (auth)

33980 CONSERVATION LAWS AND EFFECTIVE NUCLEAR INTERACTION. Mikhailov, V. M. (Leningrad State Univ.). Yadern. Fiz.; 20: No. 1, 21-32(Jul 1974). (In Russian).

In framework of the random-phase approximation and based on the conservation laws, relations are obtained between the average field parameters and the effective particle-particle and particle-hole interactions. For interaction represented in a factorized form the conservation laws enable one to determine functional form and constants in the first terms of the expansion, that are most essential in calculating properties of low energy states. (auth)

33981 WIDE-ANGLE INTERFERENCE OF IDENTICAL PARTICLES. Kopylov, G. I.; Parzhitskii, S. S.; Podgoretskii, M. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 20: No. 1, 223-232(Jul 1974). (In Russian).

A scheme is considered to measure the widths of nuclear excited levels by means of the interference method. Symmetry in the position of counters is essentially used. Properties of triple interference and the possibilities to observe it are studied. (auth)

33982 WEAK NUCLEON INTERACTION AND NUCLEAR STRUCTURE. Lobov, G. A. (Inst. of Theoretical and Experimental Physics, Moscow). At. Energy Rev.; 12: No. 3, 505-551(1974).

The review discusses the current status of the problem of nuclear forces that do not conserve parity. The following experimentally observed effects of these forces are considered: alpha decay absolutely forbidden by the law of parity conservation; angular asymmetry of the photons emitted by polarized nuclei; and circular polarization of the photons emitted by nonpolarized nuclei. Various models of weak interaction leading to the nonconservation of parity in nucleon interactions are discussed. The influence of effects associated with nuclear structure, both short-range and long-range correlations, on the weak interaction of nucleons has been observed. Phenomena that enhance the effects of the weak interaction of nucleons in nuclei are discussed. A number of experiments are suggested for the investigation of nuclear forces that do not conserve parity. The possible isotopic structure of these forces is discussed. (7 figures, 4 tables, 165 references) (auth)

33983 NUCLEAR MANY-BODY PROBLEM. Volume II. Proceedings of the International Symposium, Rome, Italy, September 19-23, 1972. Calogero, F.; Ciofi Degli Atti, C. (Eds.). Bologna; Editrice Compositori (1973). 792p. (CONF-720933-P2).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972).

Thirty-three papers are included; each paper is listed by title. (LBS)

For title listings of individual papers see: 33197, 33198, 33384-33388, 33583, 33799-33801, 33821, 33822, 33849, and 33984-34002.

33984 SOLUTION OF THE BETHE-GOLDSTONE EQUATION. Kallio, A. (Univ. of Oulu, Finland). pp 3-20 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33985 MANY-BODY PERTURBATION THEORY OF THE EFFECTIVE INTERACTION IN NUCLEI. Kirson, M. W. (Weizmann Inst. of Science, Rehovot, Israel). pp 21-49 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33986 PERTURBATION SERIES APPROACH TO NUCLEAR MATTER. Baker, G. A. Jr. (Cornell Univ., Ithaca, NY). pp 50-59 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33987 SINGLE-PARTICLE REMOVAL ENERGIES IN MANY-BODY THEORIES. Koltun, D. S. (Univ. of Rochester, NY). pp 88-112 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33988 MICROSCOPIC THEORY OF THE CONTINUOUS SEPARATION-ENERGY SPECTRUM IN QUASI-FREE SCATTERING (GREEN'S FUNCTION AND SHELL-MODEL APPROACHES). Fritsch, W.; Lipperheide, R.; Wille, U. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). pp 113-122 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33989 STRUCTURE OF SPHERICAL NUCLEI IN THE LOCAL DENSITY APPROXIMATION. Sprung, D. W. L. (McMaster Univ., Hamilton, Ont.). pp 123-164 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33990 SIMPLE AND EXACT METHOD FOR CALCULATING THE REACTION MATRIX IN FINITE NUCLEI. Barrett, B. R. (Univ. of Arizona, Tucson). pp 165-204 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33991 RENORMALIZED BRUECKNER–HARTREE–FOCK APPROXIMATION. Becker, R. L. (Oak Ridge National Lab., TN). pp 205-240 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33992 DEFORMED BRUECKNER–HARTREE–FOCK CALCULATIONS. Ford, W. F. (Lewis Research Center, Cleveland); Braley, R. C.; Becker, R. L.; Patterson, M. R. pp 241-264 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33993 FACTOR-CLUSTER EXPANSION AS A FRAMEWORK FOR MANY-BODY THEORIES. Clark, R. W. (Washington Univ., St. Louis); Ristig, M. L. pp 273-298 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33994 STRUCTURE AND RENORMALIZATION OF THE FACTOR-CLUSTER EXPANSION. Ristig, M. L. (Univ., Cologne); Clark, J. W. pp 299-322 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33995 DIAGRAMMATIC ANALYSIS OF THE JASTROW THEORY. Woo, C. W. (Northwestern Univ., Evanston, IL). pp 323-342 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33996 PAIR DISTRIBUTION FUNCTION AND THE CONDITIONS IMPOSED IN JASTROW METHOD FOR NUCLEAR MATTER. Grypeos, M. E. (Univ. of Thessaloniki, Greece); Mavrommatis, E. pp 343-346 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33997 HIGH-ENERGY SCATTERING FROM NUCLEI AND THE CORE PROBLEM IN THE NUCLEAR FORCE. Ciofi degli Atti, C. (Instituto Superiore di Sanita, Rome). pp 365-431 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33998 COUPLED-CHANNEL CALCULATIONS OF PION ABSORPTION BY NUCLEI. Morris, J. W. Jr. (Univ. of Virginia, Charlottesville); Weber, H. J. pp 461-477 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

33999 CALCULATIONS OF SUPERHEAVY NUCLEI. Wilets, L. (Univ. of Washington, Seattle). pp 481-504 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

34000 COLLAPSED NUCLEI AND NUCLEAR COLLAPSE. Bodmer, A. R. (Argonne National Lab., IL). pp 505-534 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

34001 TENSOR-BOUND AND SPIN–ORBIT-BOUND NUCLEAR MATTER AND NUCLEI. Calogero, F. (Univ., Rome). pp 535-566 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

34002 A-PARTICLE BINDING IN NUCLEAR MATTER. Bodmer, A. R. (Univ. of Illinois, Chicago); Rote, D. M. pp 567-584 of Nuclear Many-Body Problem. Vol. II. Calogero, F. (Ed.). Bologna; Editrice Compositori (1973).

From symposium on present status and novel developments in the nuclear many-body problem; Rome, Italy (19 Sep 1972). See CONF-720933-P2.

34003 METHOD OF ANGULAR POTENTIAL FUNCTIONS. General Formulas. Gorbatov, A. M. (Kalinin State Univ., USSR). Yadern. Fiz.; 20: No. 2, 326-333(Aug 1974). (In Russian).

Orthonormalized basis of angular potential functions is constructed for nuclei with arbitrary number of nucleons. (auth)

34004 DETERMINATION OF THE ATOMIC NUMBER DEPENDENCE OF THE INELASTICITY COEFFICIENT IN INTERACTION OF NUCLEONS OF COSMIC ENERGIES WITH NUCLEI. Azaryan, M. O.; Gevorkyan, S. R.; Mamidzhanyan, E. A. (Erevan Physics Inst.). Yadern. Fiz.; 20: No. 2, 398-401(Aug 1974). (In Russian).

The dependence of the inelasticity coefficients upon the atomic number is studied in the interactions of high energy protons (E_{lab}) = 1350 GeV) with nuclei. The earlier experimental data are compared with the theoretical values predicted by the Glauber theory. It is shown that the atomic number dependence of the inelasticity coefficients of the type $K_{NA} \sim A^{0.09 \pm 0.03}$, experimentally found in cosmic rays, agrees with theoretical predictions. (auth)

34005 ESTIMATION FOR THE POSSIBILITY TO USE SEMICONDUCTOR X-RAY DETECTORS TO HAVE AN EVIDENCE FOR DOUBLE BETA PROCESSES. Berenyi, D.; Hock, G. (Inst. of Nuclear Research, Debrecen, Hungary). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 83-89(1974).

The possibility of using the X-rays from a certain type of double beta process and the recent techniques of x-ray semiconductor detectors to obtain evidence for the existence of double beta processes is examined. (1 figure, 2 tables) (auth)

34006 THEORETICAL PREDICTION OF PARITY-VIOLATING NUCLEAR POTENTIAL. Tadic, D. (Inst. Ruder Boskovic, Zagreb). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 103-117(1974).

Some facts from the vast subject of parity-violating (pv) nuclear interactions are highlighted. The one-meson-exchange contributions to the pv NN potential can be divided into two groups according to the isospin selection rules. The reaction $n + p \rightarrow d + \gamma$ measures part of the pv potential analogous to the vector meson exchange potential, V_ρ, but the theoretical value of the circular γ-ray polarization has the wrong sign and is off by an order of magnitude. One possible way out is that V_ρ is not given correctly by the factorization approximation, and this is discussed briefly. As the determination of the pion exchange potential, V_π, depends on the hyperon non-leptonic decays, one has to take into account fits of the experimental decay amplitudes. New unified field theory can also lead to new predictions. Finally, the off-mass-shell effects can be of importance, leading to the OPE contribution. The discussion of the OPE pv potential is the main topic of this paper. In conclusion, pv $NN\pi$ amplitudes are considered in relation to the unified field theory, where they are even more important for studying weak interactions than for conventional models. (RWR)

34007 EFFECT OF THE DIFFUSENESS OF THE NUCLEAR BOUNDARY ON THE HEIGHT OF FISSION BARRIER AND THE SHAPE OF FISSIONABLE NUCLEI AT THE SADDLE POINT. Tyapin, A. S. Yadern. Fiz.; 20: No. 2, 279-282(Aug 1974). (In Russian).

The effect of the diffuseness of the nuclear boundary on the height of fission barriers and on the effective momenta of inertia of nuclei at the saddle point was studied. For the best empirical value of the parameter $(Z^2/A)_{cr}$ this effect produces the increase of the effective momenta of inertia by about 7% for the equilibrium shapes of nuclei without a neck. The theoretical determination of the parameter $(Z^2/A)_{cr}$ without diffuseness of the nuclear

boundary seems to be in error since the calculation of the above mentioned quantities, because the parameter Z^2/A is decreased by 9% due to the diffuseness. (auth)

34008 USE OF B. C. S. APPROXIMATION FOR THE STUDY OF SUPERCONDUCTING NUCLEI. Ceausescu, V.; Raduta, A.; Sandulescu, A. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 25: No. 4, 487-508(1973). (In Rumanian).

The discussion covers the pairing hypothesis, the pairing in the nucleus, the parametrization of the ground state wave function and the pairing equations, the method of canonical transformation and the motion equation's method. (auth)

34009 LANE'S POTENTIAL AND EQUATIONS. Popescu, D.; Simion, V. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 26: No. 3, 313-340(1973). (In Rumanian).

The topics discussed are isospin, isospin in the nuclear potential, and the Lane equation and approximations. (auth)

34010 FURTHER INVESTIGATIONS ON NONUNIQUE FORBIDDEN ELECTRON CAPTURE RATIOS. Vatai, E. (Inst. of Nuclear Research, Debrecen, Hungary). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 91-94(1974).

Some of the problems concerning the atom, the nucleus, and weak interactions upon which electron capture (EC) sheds light are reviewed. These include the following: It has been proved that atomic electrons do not take part in EC separately; rather, the total atomic cloud and the nucleus comprise an interacting system. The K/β^+ ratios are sensitive to the presence of second-class currents in the weak interaction. EC ratios can be used to investigate the nuclear matrix elements in nonunique EC. Q_{EC}, L/K, and $(L_1 + L_2)/K$ are tabulated for second-forbidden nonunique ground-state EC transitions of ^{36}Cl, ^{53}Mn, ^{59}Ni, and ^{97}Tc. Positron emission is possible energetically for ^{36}Cl and ^{59}Ni, and in these cases the K/β^+ ratio can be used for the determination of nuclear matrix elements. (RWR)

34011 COMMENTS ON PARTIAL TRANSITIONS IN THE NORMAL NUCLEAR MUON CAPTURE. Ozievicz, Z. (Univ., Wroclaw). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 67-81(1974).

The multipole amplitudes for partial normal muon capture and their relation to the multipoles for nuclear radiation processes are discussed first. (The normal process is defined as muon capture with no break-up of the daughter nuclear state. The normal partial lepton (electron or muon) capture process could be described kinematically as the two-body decay of the corresponding (mu-mesic) atom.) Information lost by considering only the partial capture rate is examined with muon capture in oxygen, $^{16}O\ \mu \rightarrow {}^{16}N\ (1^-)$, as an example. It is shown that angular distribution or polarization measurements are very important for future developments of the theory. Then exotic currents in the impulse approximation are taken up, and it is found that the sign of the circular polarization of the nuclear gamma rays may give important information on exotic currents in muon capture. The induced pseudoscalar term contributes only to the satellite axial A_L multipole; it cannot in principle be separated from the nuclear structure-dependent component. The latter (Foldy–Walecka parameter) can not be determined from independent experimental data. (1 figure, 3 tables) (RWR)

34012 GAUGE THEORIES OF WEAK INTERACTIONS AND ITS LOW ENERGY CONSEQUENCES. Pietschmann, H. (Univ., Vienna). ATOMKI (At. Kut. Intez.) Kozlem., Suppl.; 16: No. 2, 3-10(1974).

The purpose of this work is to show in a straight-forward manner how low-energy, parity-violating potentials are derived from the gauge model of Salam, Ward, and Weinberg [Salam and Ward, Phys. Lett., 13, 168 (1964); Weinberg, Phys. Rev. Lett., 19, 1264 (1967); ibid., 27, 1688 (1971)]. Specifically, it is shown that the Salam–Ward–Weinberg model predicts a parity-violating potential for electrons orbiting a nucleus of Z protons and N neutrons of the following form: $V_{p.v.} = G/4\sqrt{2}m_e\ (\vec{\sigma}\vec{p})^3\ (r) + \delta^3(r)\vec{\sigma}\vec{p})Q_W(Z,N)$. Masses of intermediate bosons are addressed. (1 figure) (RWR)

34013 PROPERTIES OF NUCLEAR MATTER WITH RANK 6 NONLOCAL SEPARABLE INTERACTIONS. Meunier, J. P.; Pigeon, J.; Nahabetian, R. (Lyon Univ., Villeurbanne, France). Compt. Rend., Ser. B; 278: No. 1, 29-32(2 Jan 1974). (In French).

The properties of nuclear matter in the nonlocal separable interactions proposed by F. J. D. Serduke are studied. The Brueckner–Goldstone G matrix (first approximation) is used for this purpose with the various generally accepted approximations. (FR)

34014 MICROSCOPIC THEORY OF ROTATIONAL MOTION IN DEFORMED ODD-MASS NUCLEI. II. The Construction of the Intrinsic State. Iwasaki, M.; Matsuzaki, M.; Yamamura, M. (Kyoto Univ.). Progr. Theor. Phys. (Kyoto); 51: No. 2, 506-517 (Feb 1974).

In order to get the physical meaning of the results obtained in the preceding paper, especially those of the differences between even- and odd-mass systems, in relation to the Hartree model, the concept of the intrinsic state is introduced. It is shown that the intrinsic state can be well constructed on the basis of the idea given by Shono. With the aid of this intrinsic state, it can be concluded that the differences are attributed to the difference of the intrinsic structures between even- and odd-mass systems. It is also shown that the results obtained in the preceding paper are quite consistent with those calculated by the deformed Hartree model. (auth)

34015 PROGRAM FOR CALCULATING THE EXPERIMENTAL PHOTONUCLEAR CROSS SECTIONS. Carstoiu, B. (Inst. of Nuclear Technology, Bucharest); Deberth, C. Stud. Cercet. Fiz.; 25: No. 7, 789-799(1973). (In Rumanian).

The program written for calculating the experimental photonuclear cross sections, their errors and the resolution matrix for a given set of measured photonuclear yield data, is a FORTRAN IV program named the code RFN-CATALINA. The method of calculation employed follows very closely the Cook's "least structure method". The code has the advantage that the bremsstrahlung matrix is calculated by the program itself, according to the specificity of each reaction and step of the photonuclear measurements. A listing together with other details are given. The code is operable on the IBM 360-370 computers under Disk Operating System. (auth)

PHYSICS (RADIATION AND SHIELDING)

34016 (GSF-K-74) ORIGIN, PROPERTIES, AND DETECTION OF NUCLEAR RADIATION. Goettel, K. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). Apr 1973. 34p. (In German).

For the non-expert, a brief, easy-to-understand survey is presented on atomic structure, radioactive decay, radiation properties, measurement units for activity and dose, and detection methods and detectors. (8 figures, 3 tables) (GE)

Radiation Physics

Refer also to abstracts 32200, 32376, 32380, 32441, 32560, 32918, 33134, 33833, 33942, and 34495.

34017 (BNWL-1850(Pt.4), pp 41-83) RADIOLOGICAL AND CHEMICAL PHYSICS. Feb 1974.

In Pacific Northwest Laboratory annual report for 1973 to the USAEC Division of Biomedical and Environmental Research.

Progress is reported in the following areas of radiation physics; low-energy electron emission, electron emission from molecular targets, theoretical electron emission cross sections, electron ejection from carbon foils, computer simulation methods for track structure, direct calculation of energy straggling parameters, pulsed radioluminescence, and data buffer interface for a PDP8 computer. In radiation dosimetry, the following are discussed: hit theory, dose rate and energy density effects, models for inactivation by interaction of radiation products, energy deposition theory, and irradiation facilities and dosimetry. The following radiation biophysics topics are presented: radiation sensitivity in the cell cycle, Chinese hamster ovary tissue culture, and lethal and mutagenic responses of Chlamydomonas reinhardi. (MHR)

34018 (CEA-R-4582) MOBILITY SPECTRA OF IONS CREATED IN GAS AT ATMOSPHERIC PRESSURE. Cabane, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Aug 1974. 123p. (In French). Dep. NTIS (U. S. Sales Only) $9.25.

Thesis. Submitted to Univ., Paris.

The mobility of ions with diameters ranging between 1 and 50 Å created by α ionization was studied at atmospheric pressure in various gases (air, N_2...). The mobility was obtained by measuring the time of flight of the ions through a plane grate system. As a function of the contact time of the ions with the vector gas (varying between 1 and 500 ms) and its hygrometric degree (from 1 to 15,000 parts per millions) two classes of ions were observed. The former included ions with fairly high mobility ($K > 1$ cm^2 V^{-1} s^{-1}, $d < 15$ Å) which were, for short times or low hygrometry, the products of the ionization of the vector gas and, for long times or high hygrometry, hydrates $A^+ (H_2O)_n$, some of which were particularly stable. The latter included ions with lower mobility ($K < 1$ cm^2 V^{-1} s^{-1}, $d > 15$ Å) which developed steadily with time or hygrometry. Moreover the ion mobility was seen to vary with the electric field when the contact time of the ions with the gas and the gas hygrometry were kept constant. (auth)

34019 (CONF-721001-, pp 20-49) PRIMARY PROCESSES IN THE PHYSICAL STAGE. Brandt, W. (New York Univ., NY); Ritchie, R. H. 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

An overview of the early physical stages in the deposition of energy in condensed matter by ionizing radiation is presented. The scale of distances associated with the track of a charged particle is analyzed, and the sizes of the ultratrack, the infratrack, the range of delta rays, and the De Broglie wavelength of the particle are compared at various energies. The excitation, propagation, and subsequent localization of collective valence electron motion in condensed media (plasmon-like behavior) are considered. Some possible nonlinear interactions among certain products of excitation and ionization in the region of dense energy deposition in the infratrack are discussed. (auth)

34020 (CONF-721001-, pp 51-67) CRITIQUE OF CROSS-SECTION DATA GOVERNING THE PHYSICAL STAGE OF RADIATION ACTION. Inokuti, M. (Argonne National Lab., IL). 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

Cross sections for inelastic scattering of fast charged particles are crucial for complete elucidation of the physical stage, insofar as it can be distinguished from the chemical and biological stages. Also, cross sections for photoabsorption and photoionization in vacuum ultraviolet and soft x-ray regions are highly relevant. Current sources of data, both experimental and theoretical, on those cross sections are briefly surveyed. Criteria that serve as a means of testing some aspects of the cross sections are discussed. Specific items of discussion include the generalized oscillator strength, energy and angular distributions of ejected electrons, and total excitation and ionization cross sections. An attempt is made to indicate studies worth emphasis in the immediate future; these include extensive mapping of partial photoionization and photodecomposition cross sections for various product states and measurement of secondary electrons in coincidence with specified energy losses from an incident particle. (auth)

34021 (CONF-721001-, pp 68-111) ATOMIC AND MOLECULAR EFFECTS IN THE PHYSICAL STAGE. Green, A. E. S.; Miller, J. H. (Univ. of Florida, Gainesville). 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

Analysis of the physical stage of energy deposition based on detailed assignment of cross sections for the major atomic and molecular processes is discussed. Emphasis is given to the important role of low-energy secondary electrons in the overall deposition process for any primary particle. Various techniques for identifying electron-impact excitation, ionization, and dissociation cross sections are reviewed. Efficiencies calculated in a continuous-slowing-down approximation are presented for electron and proton deposition in water vapor. The use of stochastic methods is also discussed, and some effects of the condensed phase are explored. (auth)

34022 (CONF-721001-, pp 126-130) SURVEY OF MULTIPLE EXCITATION IN COMPOSITE MOLECULES. Kasha, M. (Florida State Univ., Tallahassee); El-Bayoumi, M. A. 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

This study explores the range of multiexcitation phenomena in multimolecule systems. The interaction of one photon with a cluster of two or more molecules and the interaction of two or more photons with one or more molecules is considered. The phenomena include (1) molecular excitons, (2) vibrational–relaxation excitation transfer, (3) charge-transfer complexes, (4) molecular excimers, (5) simultaneous transitions, (6) triplet–triplet annihilation, (7) exciton fission, (8) successive excitation, (9) nonlinear (biphotonic) absorption, and (10) biprotonic photoautomerism. (auth)

34023 (CONF-721001-, pp 224-254) EFFECTS OF SPATIAL-TEMPORAL DISTRIBUTION OF PRIMARY EVENTS. Rossi, H. H.; Kellerer, A. M. (Columbia Univ., New York). 1974.

From conference on physical mechanisms in radiation biology; Airlie, Virginia, USA (11 Oct 1972).

In physical mechanisms in radiation biology.

Three general methods whereby we can improve our understanding of the biophysical effect of a physical agent are: (1) Attempt to follow the series of processes taking place beginning with the interaction of the agent and the biological system. (2) Try to unravel the causal chain backward beginning with the effect. (3) Search for basic rules that govern the overall process. A few years ago Rossi, considering these approaches in an evening lecture to the Radiation Research Society, concluded that in radiobiology only the third line of attack holds any real promise, at least at this time. A modified copy of his address makes up the first section of this paper to develop this argument and to furnish a simple introduction to the subject. Microdosimetry provides some of the physical concepts required for what we term the "theory of dual radiation action". In the second section we summarize the current status of this theory. (auth)

34024 (CONF-730618-, pp 297-299) ION RANGES IN EVAPORATED TARGETS. Arnesen, A.; Noreland, T. (Univ. of Uppsala). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

When making ion implantations it is sometimes necessary to know the depth distribution of the implanted ions in the target material. Determinations of such distributions have been made for many combinations of ion and target with the anodic oxidation-, back scattering-, etching and polishing methods, which all have limitations in applicability and accuracy. The lack of detailed data for several ion-target systems to be used in electron spectroscopy measurements thus led to attempts to determine depth distributions with evaporation techniques. The method is simple: with the now commercially available crystals it is possible to deter-

mine the thickness of evaporated layers with great accuracy. Thus layers of different thickness of the material to be investigated are evaporated on a suitable backing. Then, in analogy with the anodic oxidation-, etching- and polishing techniques, a radioactive isotope is implanted. The activity is measured, the evaporated layer dissolved and finally the residual activity is determined. Using a standard evaporation (or sputtering) chamber it is possible to treat a large number of materials in this way. One may however get problems with "island formation" in very thin layers and varying crystal structure due to the evaporation conditions. The method has been used for ^{57}Co in Al and Au. The results are checked with the anodic oxidation method. (auth)

34025 (CONF-730618-, pp 300-306) STUDY OF DOSE EFFECTS ON THE RETENTION OF IONS IMPLANTED AT keV ENERGIES. Santry, D. C. (Chalk River Nuclear Labs., Ont.). Aug 1973.

From 8th international EMIS conference on low energy ion accelerators and mass separators; Skovde, Sweden (12 Jun 1973).

Many measurements performed on ion implanted samples are known to be susceptible to dose and dose-rate effects. The way retention of implanted ions is also affected by dose is described. Studies on the release of radioactive "tracer" implants as a function of subsequent stable ion dose have shown that the activity release is greater than the simple sputtering picture would predict. The technique described is useful for establishing dose limits where diffusion and sputtering of implanted atoms become significant. Also described is a target holder which is used on the Chalk River separator for routine ion implantations. By means of a simple vacuum lock, targets can be quickly introduced into and removed from a Faraday cup located in the separator's collection chamber, without disrupting the operation of the separator. The beam current and integrated beam current for an implanted target are then determined directly. Used in conjunction with beam sweeping techniques and apertures, the cup measures the number of ions per cm^2 which are implanted into a target. (auth)

34026 (COO-78-325, pp 1-17) RADIATION PHYSICS SECTION. Gregg, E. C.; Rosenberg, H. M.; Voelkner, W. H.; Adams, R. B. 1974.

In annual report for period ending April 30, 1974.

Research in the following areas of radiation physics is reported: ionization in liquids, imaging with the spiral scanner, radiation resistant mammalian cells, and properties of mammalian surface membranes relating to Na/K transport sites. (MHR)

34027 (GSF-S-165) STUDIES ON LET SPECTROMETRY. Maier, E. (Technische Univ. Muenchen (F. R. Germany). Inst. fuer Mess- und Regelungstechnik; Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). 1972. 51p. (In German).

Thesis.

It is shown that it is possible to determine LET spectra and quality factors of mixed radiation fields by means of sealed, industrially fabricated proportional counters. For this purpose a microdosimetric measurement device has been set up. The event spectra of seven monoenergetic neutron fields between 0.2 and 15 MeV and of a 1 Ci Am–Be source have been measured and the LET spectra derived. Sometimes good agreement with literature values has been found for the quality factors. For a neutron energy of 0.5 MeV, for $d = 1\,\mu$, however, the QF value was found to be 10% higher than the literature value. A recalculation for $d = 2\,\mu$ with the assumption of a rectangular distribution showed that the quality factor was in agreement with the value for $d = 1\,\mu$, with a deviation of 2%. From this it is concluded that the quality factor of 10 for 0.5 MeV neutrons is too low. It should lie between 10.8 and 11.0. Also for neutron energies of 2.5 and 15 MeV higher quality factors than those published in literature have been measured. (GE)

34028 (GSF-S-209) INFLUENCE OF THE IRRADIATION FIELD SIZE ON X-RAY ATTENUATION. Goettel, K.; Kraft, A. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). Dec 1972. 14p. (In German).

In the preliminary norm DIN 6845(1) the term "degree of attenuation" is defined and an order for the measurement of degrees of attenuation is fixed. The present work investigates which irradiation field size and which saturation value of the dose rate is necessary to carry out a normal measurement of degrees of attenuation of x-rays up to 300 kV for various building and shielding materials. It is shown that only 95% of the saturation dose rate is required for a suggested measured field size of 50×50 cm^2. (GE)

34029 (KFK-1937) MULTIPLE SCATTERING OF GAMMA RAYS ON FERROMAGNETIC PLATES. Bock, P. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). May 1974. 100p. (In German). Dep. NTIS (US Sales Only) $8.00.

If nuclear gamma rays are scattered on a magnetized metal plate, the intensities from double and triple scattering depend on the magnetization. This effect arises mainly from Faraday rotation of the photon polarization plane in the target. Its size was calculated with a computer for some photon energies and scattering angles. The results are needed as corrections in experimental investigations of the left-right asymmetry in Compton scattering. (auth)

34030 (KFKI-74-57) CALCULATIONS ON THE DOSE DECREASING AND IMAGE QUALITY IMPROVING EFFECTS OF AN ABDOMEN DODGER. Koblinger, L. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1974. 11p. Dep. NTIS (US Sales Only) $4.00.

Monte Carlo calculations are performed to study the effects of an abdomen dodger. For this study the inhomogeneous Synder phantom is assumed to be irradiated by an x-ray tube operated at 80 kVp. By the use of a dodger which compensates the varying thickness of the body the exposure distribution on the photoreceptor can be made more uniform and the absorbed dose decreases. (auth)

34031 (KFTI-73-26, pp 87-88) PROTONS AND ELECTRONS ACOUSTIC EFFECT IN CONDENSED MEDIA. Borshkovskii, I. A.; Volovik, V. D.; Gol'din, L. L.; Kleinbok, Yu. L.; Lomanov, M. F.; Petrenko, V. V. 1973. (In Russian).

From tenth final seminar of the accelerator department of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. high energy physics and nuclear physics.

The results of studies on the excitation of elastic waves in aluminum by a proton beam are presented. These include a Bragg curve for a Plexiglas absorber at $E_p = 70$ MeV and the dependence of the amplitude of the acoustic signal on proton energy in the range $E_p = 30-200$ MeV. Comparison of the signals in thin ($d = 2$ mm) and thick ($d = 5$ cm) aluminum targets showed that the amplitude of the sound waves is proportional to the energy loss at $E_p = 200$ MeV and to the number of protons in the synchrotron pulse. (INIS)

34032 (LA-UR-74-1262) NEW TRANSPORT METHODS AND CODES. Lathrop, K. D. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 9p. (CONF-740903-5). Dep. NTIS $4.00.

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974).

New developments in deterministic numerical solution of the Boltzmann transport equation are reviewed. Applications of the finite element method in the FENT and TRIPLET codes to achieve flexible geometric representations are described. The role of the finite element method in mitigating ray effects is examined, and criteria for a next-generation transport code are suggested. The use of the finite element method to solve the integral transport equation is described. A refinement of an already powerful method to accelerate convergence of transport iterative processes is discussed, and directions of future research in this area are outlined. The use of code restructuring and data management to improve the efficiency of large transport codes is discussed, and the implementation of such techniques in the DOT-IV code is described. Comments on the "economy" of computing are made. (auth)

34033 (UCID-15917) SIMPLE FIT FOR THE HOT COMPTON CROSS SECTION. Cooper, G. E.; Cummings, J. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Sep 1971. 4p. Dep. NTIS $4.00.

Monte Carlo calculations of radiation transport in hot gases require an accurate evaluation of total Compton cross section as a function of both photon energy and electron temperature. The quantity has been calculated numerically for photons in a relativistic electron gas and shows a very smooth dependence on the variables of interest. Here, that fact is exploited to obtain a simple but accurate fit to the Compton cross section for electron temperature up to 150 keV and photon energies to 1 MeV. This fit allows rapid calculation of the total cross section with a minimum storage requirement. (MHR)

34034 (UCID-16037, p 5) THEORY OF EFFECTIVE CHARGE AND STOPPING POWER FOR HEAVY IONS. Bloom, S. D.; Sauter, G. D. 5 May 1972.

In status report to USNDC.

34035 (WASH-1176) CONDITIONS AND LIMITATIONS ON THE GENERAL LICENSE PROVISIONS OF 10 CFR 150.20. Rules and Regulations. (USAEC Division of Radiological and Environmental Protection, Washington, D. C.). 1 May 1971. 79p. Dep. NTIS $7.00.

Section 10 CFR 150.20 establishes a general license authorizing any person who holds a specific license from an "Argument State" (a state with which the USAEC has entered into an effective agreement under Section 274b of the Atomic Energy Act of

1954, as amended) to conduct the same activity in "non-agreement states" if the specific license issued by the Agreement State does not limit the authorized activity to specified installations or locations. Pertinent excerpts of the Commission's Rules and Regulations, which were in effect as of January 31, 1971, are reprinted in this pamphlet for the convenience of general licensees operating under these provisions. (MHR)

34036 STRUCTURE AND MODE OF ACTION OF A MONTE CARLO PROGRAM FOR DIRECT CALCULATION OF DOSE DISTRIBUTIONS. Doehren, F. R. v. (Mainz Univ. (F.R. Germany) Inst. fuer Biochemie). Strahlentherapie; 147: No. 5, 506-513 (May 1974). (In German).

7 figs.; 11 refs.

The irradiation conditions (geometry, dose distribution, cross sections) as well as the physical-technical conditions of the x-ray bundle (energy, distribution, photon histories) can be simulated with justifiable expenditure by using fast computers. The totality of these conditions makes possible to gain an exact and reproducible copy of the processes under x-ray irradiation of material. (GE)

34037 SPECTROMETRY OF THE QUALITY OF RAYS OCCURRING IN X-RAY DIAGNOSTICS. Czempiel, H. Muenchen, Ger.; Technische Univ. (1972). 69p. (In German). INIS.

Thesis. 51 figs.; 62 refs. With abstract. Available from TU Muenchen library.

A most complete possible description of the quality of rays appears to be desirable in the field of x-ray diagnostics, as this involves polychromatic radiations whose interaction with the body, as a result of the relatively low photon energy, is highly energy-dependent. Methods for the spectrometry of low-energy bremsstrahlung are presented and their advantages and disadvantages given. It is thus shown that the best possibility at present of carrying out quality and quantity measurements of x rays, also taking scattering into account, is the measuring method using semiconductor detectors. Thus the basic principles of this measuring method are considered in more detail and it is shown that it is possible to day to measure the spectral photon fluence directly as pulse height distribution with sufficient accuracy in the energy range of about 10 keV to 200 keV. A suitable measuring apparatus has been developed to enable the measurement of spectra of the primary and scattered radiation arising from a phantom. (GE)

34038 EXCITATIONS OF AN OPTICAL UNIAXIAL DIELECTRIC SLAB FOR RELATIVISTIC ELECTRONS. Wessjohann, H. G. (Hamburg Univ. (F.R. Germany). Inst. fuer Angewandte Physik). Z. Phys.; 269: No. 3, 269-278(1974). (In German).

8 figs.; 14 refs.

Semiclassical relativistic energy loss is calculated for fast charged particles (e.g., electrons) traversing a thin optical uniaxial dielectric slab with oblique incidence. Surface effects and retardation is taken into account. A formula for the transition radiation is obtained also. For the energy loss the dispersion of the excited modes, bulk mode, wave guide modes and surface plasmons or polaritons is investigated. (auth)

34039 SYSTEMATIC INVESTIGATIONS OF BIAXIAL PENDULUM IRRADIATION WITH 42 MeV PHOTONS AND DIFFERENT FIELD AREAS AND PENDULUM AXIS DISTANCES. Munzinger, D. Homberg/Saar, Ger.; Universitaet des Saarlandes (1972). 38p. (In German). INIS.

Thesis. 36 refs.; with figs. With abstract. Available from the library of the Univ. des Saarlandes Saarbruecken.

Systematic investigations of biaxial pendulum irradiation with 42 MeV photons at different field widths and pendulum axis distances, were carried out on the Alderson-man-phantom with membrane compartments of the physical-technical workshops, Pschylau KG Freiburg. The determined dose distribution is reproduced by means of isodoses. The individual isodoses are discussed in detail; reference is also made to the clinical application of the individual irradiations. (GE)

34040 ELECTRON ENERGY LOSS SPECTRA AND OPTICAL CONSTANTS FOR THE FIRST TRANSITION SERIES FROM 2 TO 120 eV. Wehenkel, C.; Gauthe, B. (Univ., Paris). Phys. Status Solidi (b); 64: No. 2, 515-525(1 Aug 1974).

Energy loss spectra in the first series transition metals (Ti, V, Cr, Mn, Fe, Co, Ni) were measured by transmission of 35-keV electrons through thin films (200 to 400 Å) in the spectral range 2 to 120 eV. Experimental data processing enables to distinguish between single scattering volume losses and surface losses. Characteristic functions, such as the energy loss function, the complex dielectric constant, and the optical absorption coefficient are computed and compared with results obtained by different methods. (auth)

34041 DOSIMETRIC PROPERTIES OF THE FAST NEUTRON THERAPY BEAMS AT TAMVEC. Smith, A. R.; Almond, P. R.; Smathers, J. B.; Otte, V. A. (Anderson Hospital and Tumor Inst., Houston, TX). Radiology; 113: No. 1, 187-193(Oct 1974).

From 59th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (25 Nov 1973).

Neutrons produced for therapy by bombarding beryllium with 16-, 30-, and 50-MeV deuterons are compared in terms of dose rate, skin sparing, depth dose, and field flatness. In general, the dosimetric properties improved as the energy increased, but at 50 MeV flattening filters were necessary. Isodose curves for treatment planning were generated, using the decrement-line method, and were compared to curves measured by a computer-controlled isodose plotter. This system was also employed to measure the isodose curves for wedge fields. Dosimetry checks on various patients were made, using silicon diodes as in vivo fast neutron dosimeters. (auth)

34042 COMPUTER CALCULATIONS OF DOSE FOR IRREGULARLY SHAPED FIELDS FOR COBALT-60 AND 6 MV PHOTONS. Bukovitz, A. G. (Presbyterian-Univ. Hospital, Pittsburgh). Radiology; 113: No. 1, 181-185(Oct 1974).

From 3rd international conference on medical physics including medical engineering; Goteborg, Sweden (1972).

A computer program for calculations of dose in an irregular field has been developed for ^{60}Co γ and 6 MV electron beams. The dose to a point is calculated as a summation of primary and scattered radiation components. The primary component is calculated from a mathematical expression describing the primary radiation intensity in air. The scattered radiation is calculated from scatter-air ratios for circular fields. The program requires less than $^1/_5$ of a second of computer time for each point calculated. Experimental and calculated values of dose agree to within ±3% for points within the umbra. Within the penumbra, the agreement is ±7%. (auth)

34043 RADIATION-TRANSPORT CROSS-SECTION SENSITIVITY ANALYSIS: A GENERAL APPROACH ILLUSTRATED FOR A THERMONUCLEAR SOURCE IN AIR. Bartine, D. E.; Oblow, E. M.; Mynatt, F. R. (Oak Ridge National Lab., TN). Nucl. Sci. Eng.; 55: No. 2, 147-167(Oct 1974).

A general approach to radiation-transport cross-section sensitivity analysis is introduced, and its applicability, demonstrated for a problem involving neutron and gamma-ray transport in air. The basis for the method is generalized perturbation theory using flux solutions to the transport equation and its adjoint. Both an analytical aspect of the technique, designed for surveying the sensitivity of a result to the entire cross-section data field, and a predictive aspect, designed for predicting the effect of changes in the data field, are presented. The analytic procedure is demonstrated by results that include a determination of important energy regions in the total, partial, and gamma-ray-production cross sections of nitrogen and oxygen for deep-penetration calculations of tissue dose in air. The predictive capability is illustrated for specific cross-section perturbations in the system and the effects of truncating the Legendre expansion of the scattering kernel. In addition, the applicability of the method for predicting variances in a calculated result arising from cross-section data uncertainties is demonstrated. In the sample case, the variance in the total neutron–gamma-ray tissue dose is estimated from preliminary cross-section error files given in the evaluations of the nitrogen and oxygen cross sections. (13 figures, 11 tables) (auth)

34044 PROTON DOSE APPROXIMATION IN ARBITRARY CONVEX GEOMETRY. Wilson, J. W. (Langley Research Center, Hampton, VA); Khandelwal, G. S. Nucl. Technol.; 23: No. 3, 298-305(Sep 1974).

A convenient property of energetic heavy charged particles in passing through matter is that the primaries and their secondary particles remain relatively confined to the primary beam axis. As a consequence, the particle beam in matter is not strongly affected by near boundaries and the problem of calculating dose in a complicated geometric object is greatly simplified. Furthermore, the small beam width is a useful expansion parameter to develop a series that converges rapidly for most practical dose calculations. The final result relates dose at any point in an arbitrary convex region to an integral over the fluence-to-dose conversion factors for normal incidence on a semi-infinite slab. A representation of these fluence-to-dose conversion factors and all the necessary information required to calculate dose in arbitrary convex regions of tissue for proton energies below 1 GeV are found in terms of two energy-dependent parameters and known functions. (auth)

34045 PERIODIC DEPENDENCE OF GAUSSIAN ELECTRONIC STOPPING CROSS SECTION WITH ENERGETIC IONS IN SOLID TARGETS. Kanaya, K.; Hojou, K. (Kogakuin Univ., Tokyo). Jap. J. Appl. Phys.; 13: No. 3, 393-399(Mar 1974).

Assuming a power potential between ions and atomic electrons the characteristics of the electronic stopping power of solids for

charged particles as a function of the incident energy are obtained. They exhibit a Gaussian distribution. A periodic dependence of the electronic stopping cross section is also explained in terms of the reduction of the electronic charges of ions and atoms taking account of the electron shielding effects of the most tightly bound electrons. The results are in good agreement with experiments over the energy range from a few eV to a hundred MeV. (auth)

34046 COMMENT ON STOPPING POWERS OF VARIOUS ELEMENTS FOR 7 MeV PROTONS. Ishiwari, R. (Nara Women's Univ., Japan). J. Phys. Soc. Jap.; 36: No. 4, 1218(Apr 1974).

34047 LINEARLY POLARIZED LUMINESCENCE FROM LINEAR DEFECTS. Kiflawi, I.; Lang, A. R. (Univ. of Bristol, Eng.). Phil. Mag.; 30: No. 1, 219-223(Jul 1974).

Photomicrographic studies of luminescence from cut and polished surfaces of natural and synthetic diamonds stimulated by electron bombardment (cathodoluminescence) reveal sharply defined blue-emitting lines which, it is believed, correspond to dislocations. The blue emission is linearly polarized with electric vector always parallel to the line. The degree of polarization is greatest (90% or more) when the lines are straight and oriented in (110) directions and this orientation is frequently observed. (auth)

34048 ELECTRON ENERGY LOSS MEASUREMENTS ON FLUORENE ($C_{13}H_{10}$) VAPOR AND SINGLE CRYSTALS. Venghaus, H.; Hinz, H. J. (Univ., Hamburg). Phys. Status Solidi (b); 65: No. 1, 239-247(1 Sep 1974).

Electron energy loss spectra from 0 to 40 eV were measured with 55-keV electrons on fluorene single crystals. The momentum transferred to the crystal by the electrons scattered inelastically was taken to be parallel to the main axes of the dielectric tensor $\epsilon(E)$. The energy loss functions Im $(-1/\epsilon_{ii})$ (i = x, y, z) were derived from the spectra and the tensor elements $\epsilon_{ii}(E)$ calculated from Im $(-1/\epsilon_{ii})$ by Kramers–Kronig analysis. Results are discussed in terms of excited molecular states determined by electron energy loss measurements on fluorene vapor. Results are also related to optical absorption measurements performed by other authors on fluorene in solution. (auth)

34049 DISCUSSION ON CHARACTERISTICS OF INSTALLATIONS FOR RADIOTHERAPY WITH FAST NEUTRONS AND OTHER TYPES OF HIGH-LET RADIATION. Eur. J. Cancer; 10: No. 4, 253-268(Apr 1974).

From 2nd meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; The Hague, Netherlands (3 Oct 1973).

The individual characteristics of a number of facilities available and under construction in Europe, North America, and Japan for the radiotherapeutic use of (i) fast neutrons produced by electrostatic accelerators using the $T(d,n)^4He$ reaction, and cyclotrons using the $^9Be(d,n)^{10}B$, $^9Be(^3He,n)^{11}C$ and $D(d,n)^3He$ reactions, and (ii) π-meson beams are assessed and described in eighteen separate short communications presented at the conference. (UK)

34050 STOPPING POWER OF Ti, Mo, Ag, Ta, AND W FOR 0.5 TO 1.75 MeV ^{4}He IONS. Leminen, E.; Fontell, A. (Univ. of Helsinki). Radiat. Eff.; 22: No. 1, 39-44(May 1974).

The stopping power of Ti, Mo, Ag, Ta and W for ^{4}He ions at energies of 500, 750, 1000, 1250, 1500 and 1750 keV has been measured using the backscattering technique. The intensities of the backscattering yields have been employed in the calculation of stopping powers relative to those of Al and Au, which were used as reference materials. The experimental accuracy of the results is about ±3%, which does not contain the possible errors in the reference stopping powers. The results obtained are compared with the stopping power values found in the literature for these elements. (auth)

34051 TRANSMISSION OF PROTONS THROUGH THIN CRYSTALS (REVIEW). Geguzin, Ya. E.; Fainshtein, A. L.; Markus, A. M. (Kharkov State Univ.). Metallofizika; No. 51, 3-17(1974). (In Russian).

A review is presented of studies of the characteristics of the interactions of protons (ions) with thin crystals detected during the registration of the spatial distribution of the intensity of the particle beam passing through the thin crystal. The interaction of the particle with very thin crystals with a thickness $l' \lesssim s\lambda$ (λ is the wave length of the trajectory of the channelized particles s = 1 to 3) was examined. In the case of crystals $l' \gg \lambda$, where, in contrast to the case $l' \lesssim s\lambda$, multiple scattering plays a significant role, the process of proton capture in channels from the diffused beam, the simultaneous appearance of effects of channeling and shadows, and the fine structure of points and lines on the "gap" protonogram. The characteristics of these protonograms were analyzed. This method can be considered as a new method of structural analysis. (12 figures, 66 references) (tr-auth)

34052 ENERGY DOSE CONCEPT APPLIED TO HEAVY ION TRACKS IN NUCLEAR EMULSION. Jacobsson, L.; Rosander, R. (Univ. of Lund, Sweden). Radiat. Eff.; 22: No. 2, 123-128(Jun 1974).

Experimental data on track widths in nuclear emulsion are compared with the theoretical distribution of the energy dose around the path of a moving ion. The dose distribution has been calculated following the formalism of the track formation theory developed by Katz and co-workers. The track widths have been estimated from light absorption profiles of heavy ion tracks. The profiles have been recorded with a nuclear track photometer with a narrow slit. The tracks studied were produced by stopping cosmic ray particles with the charges 6, 12, 18, 24, and 26. The measurements cover the residual range interval $0 < R \leq 1000$ μm, implying ion velocities below 0.33 c. Two types of emulsion with different sensitivity, Ilford G5 and Ilford K2, have been investigated. The measured track widths in K2 are quite well described theoretically, whereas regarding the measurements in G5 there is some disagreement between experimental and theoretical track widths. (auth)

34053 DEPTH DOSE CHARACTERISTICS AND BEAM PROFILE PROPERTIES OF CYCLOTRON-PRODUCED NEUTRON BEAMS. Parnell, C. J. (Hammersmith Hospital, London). Eur. J. Cancer; 10: No. 5, 335-338(May 1974).

From 2nd meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

Fast neutron beams produced with cyclotrons are being used increasingly for radiation therapy. The depth dose characteristics, gamma contamination and beam profile properties of these beams depend on the energy and type of the accelerated particles as well as on the reaction utilized to produce neutrons. (auth)

34054 ENERGY LOSS OF CHARGED PARTICLES IN CRYSTALS. Komarov, F. F.; Kumakhov, M. A. (Minsk State Univ.). Radiat. Eff.; 22: No. 1, 1-7(May 1974).

Charged particle energy loss has been calculated as a function of an impact parameter in a crystal. The quantum dielectric formalism is used when calculating the energy loss in the outer valence shell. Calculations have been carried out particularly for silicon including the zonal energy structure. Energy loss on inner electrons has been calculated in the semi-classical approximation and in the classical dipole approximation. The scope of applicability of the two approximations has been determined. The hyperchanneled particle energy loss to the loss in amorphous medium ratio has been calculated. This ratio is shown to display a peak at particle velocities close to atomic velocities. Relation between energy loss and local electron density has been studied. Comparison with experiment is presented. (auth)

34055 DETERMINATION OF ENERGY LOSSES OF CHANNELED PARTICLES FROM THE BACKSCATTERING SPECTRA. Rudnev, A. S.; Shyshkin, K. S.; Sirotinin, E. I.; Tulinov, A. F. Radiat. Eff.; 22: No. 1, 29-33(May 1974).

A method for determining energy losses of channeled particles from the backscattering spectra is described. The depth dependence of relative energy losses has been obtained for the ⟨111⟩, ⟨100⟩, ⟨110⟩ and {110} channels in a tungsten crystal. It has been shown that the depth dependence of the fraction of channeled particles obtained with allowance for energy losses is well described by the exponential law at all depths. (auth)

34056 DEVELOPMENTS IN ACHIEVING OPTIMUM BEAM PROFILES FOR 15 MeV NEUTRONS BEAMS. Greene, D.; Major, D. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Eur. J. Cancer; 10: No. 5, 339-342(May 1974).

From 2nd meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

The basic problems and principles involved in designing bulk shielding and collimation for a 15 MeV neutron generator are discussed. Even with shields up to 60 cm thick, the average dose level, outside the beams in a scattering medium was of the order of 1% of the dose in the center, this result being a consequence of basic difficulties in designing neutron collimators and of scattering of radiation from the main beam itself. The quality of this stray radiation is discussed and it was shown that it was dominantly γ-radiation. (auth)

34057 DOSIMETRY FOR NEUTRON RADIOTHERAPY. Rossi, H. H. (Columbia Univ., New York). Eur. J. Cancer; 10: No. 5, 333-334(May 1974).

From 2nd meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

The implications of neutron dosimetric information in radiotherapy are assessed and shown to be somewhat different from those for electromagnetic radiations. The energy dependence of

neutron RBEs makes comparisons between therapy centers difficult, even when they employ nominally equal neutron sources in different collimation arrangements. Results should probably not be correlated without prior detailed evaluations of LET spectra. In addition the RBE of neutrons appears to increase with decreasing dose, reflecting the increasing inefficiency of electromagnetic radiations at low doses; the necessity for caution in the assessment of required neutron doses in therapy, and the need for adequate shielding of radiation leakage is thereby emphasized. The OER is also a function of LET, though less dependent on neutron energy than is RBE. The OER may therefore be expected to differ comparatively little among the various neutron sources currently in use in therapy. (UK)

34058 PROBLEMS IN NEUTRON DOSIMETRY. Goodman, L. J. (Columbia Univ., New York). Eur. J. Cancer; 10: No. 5, 309-311(May 1974).

From 2nd meeting on fundamental and practical aspects of the application of fast neutrons in clinical radiotherapy; Rijswijk, Netherlands (3 Oct 1973).

A summary of problems in neutron dosimetry is presented. Two categories are distinguished: those which pertain to physical measurements and those which arise due to the nature of biological systems and the irradiation apparatus utilized, with special emphasis on the radiotherapy situation. The influence of radiation quality on almost all of these problems is discussed. (auth)

34059 ANGULAR INTENSITY DISTRIBUTIONS OF PARTICLES SCATTERED FROM ATOMIC SURFACE ROWS. Edge, R. D.; Sizmann, R.; Varelas, C. (Univ. of South Carolina, Columbus). Radiat. Eff.; 22: No. 2, 79-87(Jun 1974).

The angular intensity distribution of charged particles scattered in a forward direction from atomic rows in crystal surfaces with and without a crystallographic basis has been investigated in analytical considerations and computed specific examples. In a small region of incident angles, dependent on interaction potential, interatomic distances, and particle energy, the scattering intensity distribution exhibits a finite width of angular spread, with intensity maxima at both the smallest and largest angles. In nonprimitive rows, additional scattering maxima can emerge in between. The trajectories belonging to the peaks in the scattering distribution correspond to well-defined sets of impact parameters. (auth)

Radiation Protection Standards

Refer also to abstract 32442.

34060 REPORT TO THE INTERNATIONAL EXECUTIVE COMMITTEE OF THE THIRTEENTH INTERNATIONAL CONGRESS OF RADIOLOGY FROM THE INTERNATIONAL COMMISSION ON RADIATION UNITS AND MEASUREMENTS. Wyckoff, H. O. Strahlentherapie; 147: No. 5, 547-554(May 1974).

1 tab.

Summary of the activities of the ICRU since 1969. (GE)

Radiation Source Calibration and Standardization

Refer also to abstract 31709.

Shielding Calculations and Experiments

Refer also to abstracts 33778, 34240, and 34336.

34061 (CONF-740903-8) ORNL CROSS-SECTION SENSITIVITY ANALYSIS APPLICATIONS FOR RADIATION SHIELDING. Bartine, D. E.; Mynatt, F. R.; Oblow, E. M.; Childs, R. L.; Pace, J. V.; Engle, W. W.; Knight, J. R.; Sims, T. M. (Oak Ridge National Lab., Tenn. (USA)). 1974. 31p. Dep. NTIS $4.75.

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974).

An historical approach to the need for cross-section sensitivity analysis of radiation shielding problems is developed. The sensitivity function used in this work is then defined. The information generated in this type of sensitivity analysis may be used to identify the most important cross sections for a given problem and to correlate integral experiments with design problems. These sensitivities may also be incorporated with estimated cross-section uncertainties to predict the resulting uncertainty in a calculation, and to indicate the need for evaluation and measurement of specific cross sections. The application of this approach for the identification of important cross sections is illustrated for a one-dimensional sodium-iron system and for a two-dimensional reactor vessel head streaming problem. An initial application of sensitivity analysis to the correlation of an integral experiment with a design problem is also presented. (auth)

34062 REACTOR SHIELDING CALCULATIONS USING MONTE CARLO METHODS. Rashed, R. A. Kiel, Ger.; Kiel Univ. (1972). 86p. (In German). INIS.

Thesis. With figs. and tabs.; 18 refs. With abstract. Available from the library of Kiel Univ.

The attenuation of neutrons and γ-rays in the biological shield of a nuclear reactor is treated using Monte-Carlo methods. A method is described which permits three-dimensional calculations for shield systems with complicated materials arrangement. For this method, the computer code MOCASH was developed. With this code shielding calculations were done for pure water and for lead-water shield arrangements corresponding to the ESTAKOS shielding experiments. The calculation of flux densities and their contribution to the biological dose rate were performed in three-dimensional cylindrical geometry for three groups of neutrons and one gamma group and compared with the corresponding experimental results. (GE)

PHYSICS (THEORETICAL)

General

Refer also to abstracts 34515 and 34518.

34063 (JINR-P2-8110) LOCAL SINGULAR PART OF TWO-PARTICLE MATRIX ELEMENT OF A CURRENT COMMUTATOR. Fakirov, D. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Following the ideas considered previously and connected with one-particle matrix elements of nonequal-time current commutators which belong to Gell-Mann algebra, at equal times, a local form is found for the highest singular part of the spectral function of the matrix element $\langle\pi^+(p')|[A_\mu^{+i2}(x), A_\nu^{-i2}(0)]|K^+(p)\rangle$. (auth)

34064 EUCLIDEAN COVARIANT REPRESENTATIONS OF THE NONRELATIVISTIC CURRENT GROUP. Damaskinskii, E. V. (Leningrad Inst. of Aviation Instrument Making). Teor. Mat. Fiz.; 20: No. 2, 170-176(Aug 1974). (In Russian).

Euclidean covariant representations of the nonrelativistic current group are constructed by the method developed previously for the theory of representations of the CCR. (auth)

34065 CONSTRUCTION OF KINETIC EQUATIONS FOR NONEQUILIBRIUM QUANTUM SYSTEMS. Balabanyan, G. O. (Moscow Inst. of Electronic Machine Building). Teor. Mat. Fiz.; 20: No. 2, 250-264(Aug 1974). (In Russian).

Nonequilibrium quantum systems are considered, the evolution of which can be described by means of a certain restricted set of macroscopic observables. General scheme of constructing the Markovian solution of the Liouville equation is developed, which makes it possible to obtain closed transport equations for macroscopic observables. The general scheme is illustrated by the construction of the kinetic equations for the exciton–phonon system taking into account the pair interaction of excitons. (auth)

34066 GENERAL FORMULAS AND SELECTION RULES FOR CONFORMAL–COVARIANT EXPANSION OF THE OPERATOR PRODUCT. Dao Vong Dyc. (Joint Inst. for Nuclear Research, Dubna, USSR). Teor. Mat. Fiz.; 20: No. 2, 202-210(Aug 1974). (In Russian).

On the basis of the R-transformation law general formulas for conformal–covariant expansion of the operator product are obtained. The selection rules for the case of conserved tensor operators are pointed out. Then the results obtained are directly extended to formulas for conformal–covariant two-point and three-point correlation functions. (auth)

34067 GENERALIZATION OF THE WIGNER THEOREM ABOUT SYMMETRIES IN THE C*-ALGEBRAIC APPROACH. Kharatyan, S. G. (Inst. of Mathematics, Erevan). Teor. Mat. Fiz.; 20: No. 2, 177-180(Aug 1974). (In Russian).

Starting from the abstract algebraic definition of the probability of transition between pure states, the following generalization of the Wigner theorem is proved: C*-algebras of observables U_1 and U_2 are connected with each other by the symmetry transformation, if and only if there exists the one-to-one mapping of the set of all pure states on U_1 onto the set of all pure states on U_2, preserving the transition probabilities. (auth)

34068 USE OF FUNDAMENTAL SOLUTIONS OF ELLIPTIC EQUATIONS FOR CONSTRUCTING MONTE CARLO ALGORITHMS. Elepov, B. S.; Mikhailov, G. A. Zh. Vychisl. Mat. i Mat. Fiz.; 14: No. 3, 728-736(1974). (In Russian).

The use of "zone deviations" for the Laplace equation was proposed by Brown and extended by Muller. By means of rather complex arguments the authors had previously generalized this process to the case of the equation $\Delta u - cu - g$ by starting from a probability concept of a solution of the Dirichlet problem. This generalization is accomplished more simply by considering a special integral equation having a degenerate kernel, whose form is determined by a Green function for the Dirichlet problem. By this approach it is possible to improve the "zone deviation" algorithm for the equation $\Delta u - cu = -g$ and to estimate its efficiency. It is shown that the average number of arithmetical operations necessary to attain an error ϵ in an estimate of the solution is of the order $c_n|\ln\epsilon|/\epsilon^2$, where c_n depends linearly on the number of measurements, n. (tr-auth)

34069 PRACTICAL PROPOSAL FOR THE EXPERIMENTAL STUDY OF BORN RIGID MOTIONS. Newburgh, R. G. (Air Force Cambridge Research Labs., Bedfore, MA). Nuovo Cim.; 23B: No. 2, 365-375(11 Oct 1974).

To determine whether or not a body moving at relativistic velocities undergoes a Born rigid motion, electromagnetic standing waves can be used. An observer O' at rest with respect to the body sees a standing wave. The laboratory observer O (with respect to whom the body moves) counts the number of nodes of the moving wave. For a disk set into rotation, dilatation occurs even if the disk material has the maximum degree of rigidity allowable according to the special theory of relativity, as shown by Cavalleri. Therefore its motion cannot be Born rigid, and the ratio between the number of nodes along the periphery and the radius is greater than 2π. This non-Euclidean character of the geometry is perhaps verifiable by a piston of plasma which produces a standing wave by reflection and moves at relativistic speeds in a toroidal tube. (auth)

34070 ALGEBRAIC STUDY OF A CLASS OF RELATIVISTIC WAVE EQUATIONS. Hurley, W. J.; Sudarshan, E. C. G. (Univ. of Texas, Austin). Ann. Phys. (N. Y.); 85: No. 2, 546-590(Jun 1974).

First-order relativistic wave equations are considered whose irreducible matrix coefficients satisfy the simplest (except for the Dirac algebra) unique mass condition, $(\beta\cdot p)^3 = p^2(\beta\cdot p)$, which is also sufficient to guarantee causality in a minimally coupled external electromagnetic field. All of the associated representations of $SL(2,\mathbb{C})$ are classified and studied up to and including those which are the direct sum of four irreducible components, (n,m), with either n or m less than two. A large number of families of representations are found which permit the algebraic condition to be satisfied. These are tabulated according to whether a Hermitian choice for β^0 is possible and their spin content is given. If a unique spin is described, then the only possible representations are $(n,0)\oplus(n-\frac{1}{2},\frac{1}{2})$, $(n,0)\oplus(n+\frac{1}{2},\frac{1}{2})$,$(n+\frac{1}{2},\frac{1}{2})\oplus(n,0)\oplus(n-\frac{1}{2},\frac{1}{2})$, $(1,0)\oplus(\frac{1}{2},\frac{1}{2})\oplus(0,1)$, and their conjugates. If, in addition, the representation is assumed to be sel^c-conjugate, then only the Dirac and Petiau–Duffin–Kemmer equations survive. (auth)

34071 CLASSIFICATION OF SECOND-ORDER RAISING OPERATORS FOR HAMILTONIANS IN TWO VARIABLES. Boyer, C. P.; Miller, W. Jr. (Univ., Montreal). J. Math. Phys. (N. Y.); 15: No. 9, 1484-1489(Sep 1974).

A group theoretic method is developed based on results of Winternitz et al. to compute and classify all first- and second-order raising and lowering operators admitted by Hamiltonians of the form $H = -(\frac{1}{2})\Delta_2 + V(x,y)$. The key to these results, which generalize to higher dimensions, is a proof that H admits a second-order raising operator only if the Schroedinger equation separates in Cartesian, polar, or elliptic coordinates. (auth)

34072 QUASIPERIODIC POINTWISE SOLUTIONS OF THE PERIODIC, TIME-DEPENDENT SCHROEDINGER EQUATION. Okuniewicz, J. M. (Univ. of Minnesota, Minneapolis). J. Math. Phys. (N. Y.); 15: No. 9, 1587-1595(Sep 1974).

For Hamiltonians periodic in time, under certain assumptions a condition is obtained which is necessary and sufficient for the existence of quasiperiodic pointwise solutions to the Schroedinger equation. Orthonormality and completeness of these functions in $L^2(R^n)$ are investigated, and the time-displacement operator is considered as a sum of quasiperiodic terms. (auth)

34073 SOME CONSEQUENCES OF KINETIC THEORY FOR BOSONS. Skorobogatov, G. A.; Dzevitskii, B. E. (Leningrad State Univ.). Sov. Phys. - Dokl. (Engl. Transl.); 18: No. 10, 668-670(Apr 1974).

Translated from Dokl. Akad. Nauk SSSR; 212: No. 6, 1332-1335(Oct 1973).

The theorem is proven which states that the behavior of a sufficiently numerous collection of identical particles that interact through the two- and three-particle interactions with reaction rates of a given form is described by the boson quantum mechanical Boltzmann equation. The converse assertion can also be proven which states that it follows from a given form that all bosons have the ability to interact through the singular nonforce (i.e., one that cannot be represented by a Hamiltonian function) three-particle interaction described by the given functions. (JFP)

34074 NEW PHYSICAL CHARACTERISATION OF CLASSICAL SYSTEMS IN QUANTUM MECHANICS. Neumann, H. (Univ., Marburg, Ger.). Int. J. Theor. Phys.; 9: No. 4, 225-228(Apr 1974).

A physical characterization of classical systems in quantum mechanics is given in terms of the set of ensembles in contrast to the well-known characterizations concerning the effects or

observables: a quantum mechanical system is classical if, and only if, each two decompositions of every ensemble are compatible. (auth)

34075 QUANTUM MECHANICS PRESENTED AS HARMONIC ANALYSIS. Malzan, J. (Univ. of Waterloo, Ont.). Int. J. Theor. Phys.; 9: No. 5, 305-321(May 1974).

This paper grew out of a desire on the part of its author to be able to explain, for philosophy, the significance of Quantum Mechanics. The traditional formulation, based on Hilbert spaces and operators on them, leaves much to be desired if, for example, one is interested in the theory of physical measurement. Of great interest here, of course, are the uncertainty relations. They have done much to still the deterministic belief that nature is, at least theoretically, ultimately controllable. They have conjured up again the venerable questions about form versus substance in the theory of matter. They are, then, as fundamental to philosophy today as any other contemporary issue. And yet their explication is deeply problematical because of the relatively complicated form of the usual presentation of these relations. The reformulation of Quantum Mechanics which is presented takes its inspiration from the point of view that measurement (or physical knowledge) requires conservation laws, and that these in turn invariably involve symmetry, and hence groups. Thus, as with the uncertainty relations, a concomitant part of knowledge is an associated inability to know which arises out of a symmetry group. (auth)

34076 FERMI-LIKE QUANTISATION OF CLASSICAL MECHANICS. Ruggeri, G. J. (Univ. Central de Venezuela, Caracas). Int. J. Theor. Phys.; 9: No. 4, 245-251(Apr 1974).

Some previously obtained results concerning the quantization of classical finite models according to the symmetric (Fermi-like) scheme of quantization are generalized. Models are considered whose dynamics is defined through some non-singular Lie bracket and it is shown that the dynamics can be made with any prescribed bracket relations, as defined by a certain type of non-singular symmetric bracket, coexist. The quantization scheme established is: (a) defined up to an arbitrary factor and, (b) sensitive to the addition of total time derivatives to the corresponding Lagrangian. Both unconstrained and constrained models are considered. (auth)

34077 QUANTUM MECHANICS OF FREE SPIN-½ PARTICLES IN AN EXPANDING UNIVERSE. Audretsch, J. (Konstanz Univ., Ger.). Int. J. Theor. Phys.; 9: No. 5, 323-340(May 1974).

The gravi-quantum mechanical interaction on the level of the first quantization and in the framework of a metric theory of gravitation (no field quantization) is considered. The interaction is introduced by embedding the quantum mechanics of the otherwise unaffected (i.e. "free") spin-½ particle in the given curved space-time of the 3-flat expanding Robertson-Walker universe. The metric acts thereby as an external field. The corresponding Hilbert space formalism is established in interpreting the generally covariant theory of the Dirac field in the Riemann space in question as the Dirac representation of the spin-½ particle in the Schroedinger picture. The evolution operator is then extracted out of the general relativistic Dirac equation, while contractions of the symmetric energy momentum tensor with the tetrad vectors of the reference system lead to the operators of energy, linear momentum and total angular momentum. The temporal behavior of the corresponding expectation values is calculated. (auth)

34078 COVARIANT FEYNMAN DERIVATION OF SCHROEDINGER'S EQUATION IN A RIEMANNIAN SPACE. Dowker, J. S. (Univ. of Manchester, Eng.). J. Phys., A (London); 7: No. 11, 1256-1265(21 Jul 1974).

Ruse's (Proc. Lond. Math. Soc.; 32:87-92(1931)) covariant Taylor expansion is used to give a neat and rapid derivation of the covariant Schroedinger equation for a particle moving in a riemannian space. It is pointed out that the calculation is basically the same as Kolmogorov's derivation (Math. Ann.; 104: 415-58(1931)) of the diffusion equation, and a covariant form of the stochastic differential equation is given. (auth)

34079 SOME METHODS TO TREAT THE PAIRING FORCES. Ceausescu, V.; Raduta, A. A. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 25: No. 6, 717-748(1973). (In Rumanian).

A review of some alternatives to introduce the quasiparticle approximations is presented. In the quasiparticle approximation expressions for the single particle Green functions and correlation functions are derived. Within the "quasi-spin formalism" the canonical transformations are interpreted as a particular rotation made in the quasi-spin space. Using the quasiboson-approximations, the o vibrational modes are defined. A detailed discussion concerning the redundant mode is given. (auth)

Quantum Field Theories

Refer also to abstracts 33248, 33704, and 33955.

34080 (CRN/HE-73-17) UNIFIED GAUGE FIELD MODEL. Leite Lopes, J. (Centre National de la Recherche Scientifique, 67 – Strasbourg (France). Centre de Recherches Nucleaires). 1973. 56p. (In French). Dep. NTIS (U. S. Sales Only) $6.00.

The physical ideas which underlie the model of unified gauge fields is discussed. In spite of the difficulties which are actually found in the incorporation in a natural manner, the muons and hadrons in this model, one rather has the feeling that one is on a path which seem to lead to the construction of a theory in which the Maxwell electromagnetic field and the Fermi weak interaction field are only two manifestations of a single physical entity underlying the unified gauge fields. (tr-auth)

34081 (DESY-74/29) FEYNMAN-TYPE INTEGRALS FOR SPIN AND THE FUNCTIONAL APPROACH TO QUANTUM FIELD THEORY. Tarski, J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Jun 1974. 52p. INIS.

36 refs. With abstract.

A construction of Feynman-type integrals for systems with spin is outlined. In particular, in case of fields with half-odd-integer spin, one integrates over a space of pairs $[\eta, -\eta]$. While the problems of analysis are only briefly considered, those of geometry are treated in greater detail, and some ideas from the theory of symplectic manifolds are utilized. As a sequel to this construction, a preliminary set of axioms for quantized fields in functional form is suggested. (auth)

34082 (DESY-74/31) REPRESENTATION THEORY OF THE UNIVERSAL COVERING OF THE EUCLIDEAN CONFORMAL GROUP AND CONFORMAL INVARIANT GREEN'S FUNCTIONS. Grensing, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Jun 1974. 19p. INIS.

23 refs. With abstract.

A special realization for the universal covering of the euclidean conformal group is presented. This group can be defined as a transformation group on the euclidean version of compactified Minkowski space such that the action on this space coincides with the usual one of the euclidean conformal group. The representations of the principal and complementary series and derive the intertwining kernels for the equivalent representations are constructed. The connection between representation theory and conformal invariant quantum field theory is studied. The reduction of the tensor product of two representations of the supplementary series is also given. (auth)

34083 (JINR-E2-8085) ULTRAVIOLET ASYMPTOTICS IN RENORMALIZABLE SCALAR THEORIES. Kazakov, D. I.; Lomidze, L. R.; Makhaldiani, N. V.; Vladimirov, A. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 25p. Dep. NTIS (US Sales Only) $4.25.

The two first terms of perturbation expansion of the Gell-Mann–Low function are found in $h\phi^3$ model in six-dimensional space and in $h\phi^6$ model in three-dimensional space. The former theory appears to be asymptotically free and the latter leads to the finite asymptotical value of the invariant coupling constant. The calculations are performed using the dimensional regularization scheme. Two alternative renormalization procedures, namely the BPHZ R–operation and 't Hooft's approach are considered. For illustration the detailed calculations of some diagrams are given. (auth)

34084 (ORO-3992-147) UNITARY UNIFIED FIELD THEORIES. Sudarshan, E. C. G. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 22p. (CPT-192). Dep. NTIS $4.25.

This is an informal exposition of some recent developments. Starting with an examination of the universality of electromagnetic and weak interactions the attempts at their unification are outlined. The theory of unitary renormalizable self-coupled vector mesons with dynamical sources is formulated for a general group. With masses introduced as variable parameters, it is shown that the theory so defined is indeed unitary. Diagrammatic rules are developed in terms of a chosen set of fictitious particles. A number of special examples are outlined including a theory with strongly interacting vector and axialvector mesons and weak vector mesons. Applications to weak interactions of strange particles is briefly outlined. (auth)

34085 (ORO-3992-149) REMOVAL OF THE QUARTIC POTENTIAL IN THE UNIFIED GAUGE THEORY. Hsu, J. P. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. 7p. (CPT-194). Dep. NTIS $4.00.

The quartic potential in the unified gauge theory can be removed

without losing renormalizability and unitarity. The Lagrange multiplier fields are employed to construct the massive charged theory which is covariant, renormalizable, unitary, and gauge independent. Unitarity and gauge independence were verified up to two-loop diagrams. (auth)

34086 ANALYTICITY PROPERTIES IMPLIED BY THE MANY-PARTICLE STRUCTURE OF THE N-POINT FUNCTION IN GENERAL QUANTUM FIELD THEORY. P. 1. Convolution of n-point Functions Associated with a Graph. Lassalle, M. (Ecole Polytechnique, 75-Paris (France). Centre de Physique Theorique). Commun. Math. Phys.; 36: No. 3, 185-226(Apr 1974).

8 figs.; 30 refs.

This is the first of a series of papers devoted to the derivation of analyticity properties in the non-linear program of general quantum field theory, following the line of the 'many particle structure analysis' due to Symanzik. In this preliminary paper, 'convolution products' are associated with graphs whose vertices γ represent general n_γ-point functions. Under convergence assumptions in Euclidean directions, it is proved that any such convolution product H^G associated with a graph G with N external lines is well defined as an analytic function of the corresponding N four-momentum variables. The analyticity domain of H^G is proved to contain the corresponding N-point 'primitive domain' implied by causality and spectrum and the various real boundary values of H^G satisfy all the relevant linear relations. For appropriate boundary values, the convolution products generalize the perturbative Feynmann prescription. (GE)

34087 CONSTRUCTION OF A STRICTLY RENORMALIZABLE EFFECTIVE LAGRANGIAN FOR THE MASSIVE ABELIAN HIGGS MODEL. Piguet, O. (European Organization for Nuclear Research, Geneva (Switzerland)). Commun. Math. Phys.; 37: No. 1, 19-28(Jun 1974).

14 refs.

It is shown, using the BPHZ renormalization program and Zimmermann's normal product algorithm, that a strictly renormalizable effective Lagrangian for the Abelian massive Higgs model does exist: Ward identities are fulfilled, and normalization conditions, defining a theory in an indefinite metric Fock space, may be implemented. (auth)

34088 ANALYTIC RENORMALIZATION USING MANY SPACE-TIME DIMENSIONS. Speer, E. R. (Rutgers-the State Univ., New Brunswick, N. J. (USA). Dept. of Mathematics). Commun. Math. Phys.; 37: No. 1, 83-92(Jun 1974).

9 refs.

A renormalization method originally proposed by Ashmore is reformulated and shown to be, in fact, a renormalization. The method involves use of different complex dimensions associated with various subgraphs of a graph, and appears to combine the best features of complex dimensional and analytic renormalization. (auth)

34089 RENORMALIZABILITY OF THE UNITARY GAUGE. Woodhouse, K. A. (Imperial Coll. of Science and Tech., London). Nuovo Cim.; 23A: No. 3, 459-493(1 Oct 1974).

The divergent parts of vertex functions are calculated in the one-loop approximation of a unitary gauge theory. It is shown that finite S-matrix elements may only be obtained provided one modifies the usual renormalization prescription. (auth)

34090 RENORMALIZATION GROUP AND ITS RELATIVITY PRINCIPLE. Jouvet, B. (International Center for Theoretical Physics, Trieste, Italy). Nuovo Cim.; 23A: No. 3, 521-549 (1 Oct 1974).

After making the distinction between the renormalization operation and the renormalizability property of certain theories in canonical and noncanonical formulations of the field theory, the question of how to determine what mathematical structure governs the way the observables depend on the coupling constants is raised. It is shown that the possibility of applying the renormalization group operation to nonperturbative propagators implies the existence of a property of α-invertibility that cannot be recognized in perturbation theory and whose consequences are indicated. This property is illustrated by giving an explicit example which, though superrenormalizable in perturbation, is not consistently renormalizable. It is argued that the only justification of the renormalization group, which is always true but may be fallacious in perturbation theory, lies in a physical principle of relativity for the coupling constants. (auth)

34091 SOME STATISTICAL PROBLEMS FOR QUANTUM FIELDS. Kholevo, A. S. Theory Probab. Its Appl. (USSR) (Engl. Transl.); 17: No. 2, 347-351(Jun 1972).

Using the algebraic approach, several statistical problems for quantum boson fields such as extrapolation, filtration, and estimation of the mean are examined. (JFP)

34092 OPERATOR APPROACH TO QUANTUM ELECTRODYNAMICS IN AN EXTERNAL FIELD: THE MASS OPERATOR. Baier, V. N.; Katkov, V. M.; Strakhovenko, V. M. (Inst. of Nuclear Physics, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 67: No. 2, 453-470(Aug 1974). (In Russian).

An operator diagram technique for analysis of processes occurring in a homogeneous (constant with respect to space and time) external electromagnetic field is formulated for spin 0 and $\frac{1}{2}$ particles. The method is based on an operator representation of the Green function for a charged particle in a field. Some features of the calculations are demonstrated in the problem of determination of the mass operator. The problem is solved for the general case of a homogeneous field, and it is shown that for determination of the mean value at the mass shell it is sufficient to know only the spectrum of a certain set of operators. (auth)

34093 GENERALIZED STATIC ELECTROMAGNETIC FIELDS IN RELATIVITY. Teixeira, A. F. daF.; Wolk, I.; Son, M. M. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Notas Fis., Cent. Brasil. Pesqui. Fis.; 21: No. 16, 313-324(1974).

A general class of solutions is obtained for static cylindrically symmetric (radial, azimuthal and longitudinal) electromagnetic fields coupled with massless scalar field. These are presented all in a same reference system such that one can have Marder's solution immediately in absence of electromagnetic and scalar fields. (auth)

34094 FIELD FOR ISL(6,c) SYMMETRY GROUP. Volkov, D. V.; Tkach, V. I. (Physical-Technical Inst., Kharkov). Teor. Mat. Fiz.; 20: No. 2, 160-169(Aug 1974). (In Russian).

Introducing of the gauge fields into the spontaneously broken ISL(6,C) symmetry group is considered. This scheme describes the 2^+-nonet of the gauge fields. The distinction between the conservation laws connected with the translation group in the cases of the Poincaré group and the scheme under consideration, combining the spin and unitary spin degrees of freedom, is pointed out. The way of removing this distinction is proposed. (auth)

34095 BEHAVIOR OF THE PHYSICAL CHARGE AT SMALL DISTANCES IN NONABELIAN GAUGE THEORIES. Bogomol'nyi, E. B.; Novikov, V. A.; Shifman, M. A. (Moscow Physical-Technical Inst.). Yadern. Fiz.; 20: No. 1, 210-217(Jul 1974). (In Russian).

The behavior of the physically observed charge at small distances is studied in nonabelian gauge theories. The physical charge determined from scattering of "classical test bodies" is calculated in one-loop approximation. In nonabelian gauge theories the physical charge may be not equal to the invariant charge. The relation of the invariant charge to the physical one is discussed. It is shown that in the one-loop approximation, the behavior of the physical charge at small distances is similar to that of the invariant charge. (auth)

34096 EIGENVALUE EQUATIONS WITH DRESSED PROPAGATORS IN A POLE REGULARIZED SPINOR THEORY. Dammeier, K. (Tuebingen Univ. (F.R. Germany). Inst. fuer Theoretische Physik). Z. Naturforsch., a; 29: No. 7, 991-1002(Jul 1974).

3 figs.; 2 tabs.; 9 refs.

The massless Green's function in a pole regularized nonlinear spinor theory is dressed and the resulting eigenvalue equations are discussed. The coupling constant is more than doubled by this dressing, and the boson solutions change drastically. The old solutions disappear, a singlet deuteron solution with small binding energy appears. The fermion propagator is determined from a self-consistency requirement. (auth)

34097 LORENTZ-DIRAC EQUATION AND POSITIVE-DEFINITE ENERGY IN CLASSICAL ELECTRODYNAMICS. Leiter, D. (Univ. of Windsor, Ont.). Nuovo Cim.; 23B: No. 2, 391-401(11 Oct 1974).

It is shown that, in a previously developed theory of classical electrodynamics, where each charged classical electron has its own electromagnetic field (and the mutual interactions between a given charge and the field of another charge make up the elementary interactions of the theory), the requirement of positive-definite total energy automatically yields the generalized form of the Lorentz-Dirac equation of motion for the charges. This occurs without the presence of direct self-interactions, hence the theory is finite and consistent without the need of infinite-renormalization techniques. The proof that this new classical electrodynamic formalism produces the same class of equations of motion, as that of renormalized Maxwell-Lorentz theory (without infinities from an internal positive-definite energy criteria), suggests that an attempt to quantize the new formalism might lead to a better formulation of quantum electrodynamics. (auth)

34098 QUALITATIVE PICTURE OF HIGH-ENERGY HADRON SCATTERING IN THE SCALAR FIELD THEORY $L_{int} = g\varphi^3\varphi$.

Barbashov, B. M.; Nesterenko, V. V. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 20: No. 1, 218-222(Jul 1974). (In Russian).

High energy hadron scattering is studied in framework of a quantum field model based on the Feynman graphs with various ladder exchanges, summed up in the eikonal approximation ($L_{int} = g\psi^2\varphi$). It is shown that in this approach principal regularities of the pp scattering in the energy region $s \sim 10^3$ (GeV/c)^2 may be obtained. All the parameters presented in the consideration are expressed in terms of the strong interaction coupling constant $g^2/4\pi m^2$. It is necessary to put $g^2/4\pi m^2 \sim 25$ for satisfactory agreement with the experimental data. (auth)

34099 QUASIPOTENTIAL APPROACH TO THE TWO-BODY PROBLEM IN QUANTUM FIELD THEORY. Todorov, I. T. (International Centre for Theoretical Physics, Trieste, Italy). pp 953-979 of Properties of the Fundamental Interactions. Vol. 9, Pt. C. Zichichi, A. (ed.). Bologna; Editrice Compositori (1973).

From properties of the Fundamental Interaction NATO-MPI-MRST Advanced Study Institute meeting; Erice, Italy (8 Jul 1971). See CONF-710744-(P9)(PC).

The treatment covers three- versus four-dimensional two-particle equations, relativistic Lippman–Schwinger equation for scalar particles, scalar Yukawa interaction and relativistic eikonal formula, and quasipotential equation for electromagnetic interactions. (JFP)

34100 ABSENCE OF TRIVIAL SUBREPRESENTATIONS FROM TENSOR PRODUCTS OF UNITARY REPRESENTATIONS OF PSEUDO-ORTHOGONAL GROUPS. Fulling, S. A. (Univ. of Wisconsin, Milwaukee). J. Math. Phys. (N. Y.); 15: No. 9, 1567-1570(Sep 1974).

A unitary tensor product representation of the group $SO_0(1,n)$, n = 2,3,4, does not contain the trivial representation as a discrete direct summand unless each of the factors does. (auth)

34101 INVARIANTIVE PROPERTIES OF THE ELECTROMAGNETIC FIELD. Ionescu-Pallas, N. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 25: No. 4, 447-470 (1973). (In Rumanian).

Invariantive aspects of the equivalence between magnets and currents, invariantive aspects of the law of interaction between currents, the necessity of introducing the "invariantive mechanics" in electrodynamics, the condition of compatibility between electrodynamics and mechanics, dynamic and electrodynamic properties of the bodies in the "invariantive mechanics," and space-time structure of the "invariantive electrodynamics" are covered. (auth)

34102 PARTICLE LEVEL OF GALILEAN QUANTUM FIELD THEORIES. Lanz, L.; Lugiato, L. A. (Univ., Milan). Int. J. Theor. Phys.; 9: No. 5, 341-367(May 1974).

The procedure devised in previous papers (Lanz et al. Physica's Gravenhage; 54: 94 (1971) and Int. J. Theor. Phys. 8: 5; 341 (1973)) to obtain the exponential decay law for an unstable non-relativistic isolated particle within a Galilean Quantum Field Theory is applied to describe the transition from the particle to its decay products, as well as the transitions occurring in scattering processes. (auth)

34103 RELATIVISTIC THEORY OF NUCLEONS IN LASER FIELDS. Becker, W.; Mitter, H. (Univ., Tuebingen, Ger.). J. Phys., A (London); 7: No. 11, 1266-1273(21 Jul 1974).

The Dirac equation for a particle with a spin ½ and an anomalous magnetic moment in an external wave field is reduced to a set of coupled ordinary differential equations for a spin factor, in which the wavefunction differs from the corresponding one for a "normal" particle. Exact solutions are given for a linearly polarized laser wave of finite length and for an infinitely extended plane wave with circular polarization. (auth)

34104 YUKAWA INTERACTION IN THE QUANTUM FIELD THEORY OF NON-LINEAR REALIZATION. Okabayashi, T.; Kikugawa, H. (Tokyo Univ.). Progr. Theor. Phys. (Kyoto); 51: No. 4, 1239-1254(Apr 1974).

The quantization method based on the characteristics of displacement operators in Minkowski space is generalized so that we can deal with general local interactions in the non-linear realization. As a typical case of such interactions the pseudovector coupling of a pseudoscalar field with a spinor field is discussed. (auth)

Gravitation and General Relativity

Refer also to abstracts 33281, 33394, and 33600.

34105 INVESTIGATION OF A CLASS OF GRAVITATIONAL FIELDS OF DUST CHARGED MATTER. Shikin, I. S. (Moscow State Univ.). Zh. Eksp. Teor. Fiz.; 67: No. 2, 433-440(Aug 1974). (In Russian).

Gravitational fields which admit 3-parametric groups of motions acting on 2-dimensional invariant varieties of positive, negative or zero curvature (spherical, pseudospherical and plane symmetries) are considered within the framework of general relativity. The source of the gravitational field is assumed to be electrically charged dust matter. Elements of the matter possess a 4-acceleration due to the presence of electric ponderomotive force. A qualitative analysis is given of the various possibilities which arise from the Einstein–Maxwell equations. Exact solutions with arbitrary functions are obtained (in two cases). Asymptotic behaviors are considered for singular states and large values of time as well as the conditions under which the solutions become asymptotically isotropic. (auth)

34106 GRAVITATIONAL WAVES. Tsou, C. L.; Chang, P. H.; Wang, C. H. (Peking Observatory). Wu-li; 3: No. 2, 100-103 (Apr 1974). (In Chinese).

A brief survey is made of the properties, the production and the detection of gravitational waves. A dual-star system is introduced as an example for making related calculations. Formulas and charts concerning the gravitational radiation power are given for reference purpose. A sketch of the Weber type, gravitational wave detector is also shown. References and bibliography are listed at the end of the text. An appendix of technical terms is also given for reference purpose. (auth)

34107 PERIODIC MOTION OF A SOLID AROUND A FIXED POINT IN A CENTRAL NEWTONIAN FIELD. Kiselev, F. I. Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat.; No. F, 84-85(1974). (In Russian).

The existence of one class of periodic motion of a solid with one fixed point in a central Newtonian gravitational field was shown by the Poincare small parameter method. The Hamiltonian form of the equation in the canonical variable of Depri was used as an example. (tr-auth)

34108 NEWTONIAN SPACE FOR CASES OF THE GRAVITATION FIELD FORMED BY A POINT MASS. Vypov, G. P. Mekh. Tverd. Tela; No. 2, 172-173(1970). (In Russian).

The gravitational field formed by a point mass was examined. The Newtonian space corresponding to this case and the density of the gravitational energy were found. (tr-auth)

34109 ENERGY RELATIONS IN THE PHYSICAL SPACE OF THE GENERAL THEORY OF RELATIVITY. Vypov, G. P. Mekh. Tverd. Tela; No. 2, 168-172(1970). (In Russian).

Some properties of space in the general theory of relativity, analogous to the properties of space in classic Newtonian mechanics were examined. It was shown that in the framework of the general theory of relativity a space can be introduced in which the equations for the gravitational potential are analogous to the corresponding Newtonian mechanics equations. (tr-auth)

34110 TIMELIKE AND NULL GEODESICS IN THE KERR METRIC. Bardeen, J. M. (Yale Univ., New Haven). pp 215, 217, 219-239 of Black Holes. New York; Gordon and Breach, Science Publishers, Inc. (1973).

From proceedings of the twenty-third summer school of theoretical physics; Les Houches, France (1 Aug 1972).

In calculating the geodesics it is assumed that the Kerr metrics are in fact the generic uncharged black hole metrics. An important property of the Kerr metrics is the fact that the Hamilton-Jacobi equation for the geodesics separates. The trajectories in the equatorial plane are considered and simplified formulas are presented for the energy and the angular momentum. The photon orbits are discussed, taking into account the apparent shape of the black hole, the throat of the extreme Kerr metric, and aspects of geometrical optics. (IAA)

34111 MACH PRINCIPLE. Sciama, D. W. (Oxford Univ.). J. Phys. (Paris), Colloq.; No. 7, 33-34(1973). (In French).

From centenary congress of the French Physical Society; Vittel, France (28 May 1973).

Two recent developments of the Mach principle are discussed. The first is observational, the second is theoretical. First a higher accuracy can be obtained in comparing the rotations of the local inertial system with a total system due to the possibility of measuring the earth motion in relation with the universal black body radiation at 3K. The upper limit of accuracy obtained is 10^{-9}'' per century for any rotation of the universe with respect to the local inertial referential system. As for the theoretical aspect, a delayed Green function has been recently derived for field equations despite the nonlinearity of Einstein equations. This permits a rigorous expression to be obtained for the Mach principle in general relativity. (auth)

34112 GENERAL RELATIVITY. The SOREL Experiment and Gravitation Theories. Marchal, C. (Office National d'Etudes et de Recherches Aerospatiales, Chatillon, France). J. Phys. (Paris), Colloq.; No. 7, 27-31(1973). (In French).

From centenary congress of the French Physical Society; Vittel, France (28 May 1973).

The different theories of general relativity and gravitation found out since that of Einstein lead to various expressions of space-time curvature around an important mass such as the sun. The resulting relativistic perturbations are sufficiently different to afford the possibility of a check experiment by the accurate analysis of the free motion of an interplanetary dragfree probe. (auth)

34113 GRAVITATION THEORIES FACING GENERAL RELATIVITY. Mavrides, S. (Univ., Paris). J. Phys. (Paris), Colloq.; No. 7, 19-26(1973). (In French).

From centenary congress of the French Physical Society; Vittel, France (28 May 1973).

Many theories of gravitation can account for the gravitational phenomena observed till now. But the number of those satisfying some theoretical claims is far more limited. The part played by different principles (weak and strong principle of equivalence, requirement of positive, definiteness of gravitational energy, principle of generalized relativity, Mach's principle) in the construction and choice of the theories of gravitation is surveyed. These theories (Lorentz-invariant Minkowskian theories, metric stratified Riemannian theories, pentadimensional Riemannian theories) are then compared to Einstein's theory of general relativity. (auth)

34114 INTRODUCTION TO THE LAST DEVELOPMENTS OF EINSTEIN GRAVITATION THEORY. Andrillat, H. (Univ., Montpellier, France). J. Phys. (Paris), Colloq.; No. 7, 5-17 (1973). (In French).

From centenary congress of the French Physical Society; Vittel, France (28 May 1973).

The Schwarzschild solution represents the spherically symmetric empty space outside a spherical massive body. Its geodesic lines describe two kinds of motions: the orbital motion with the well known advance of the perihelion and the predicted deflection of light, and the radial motion related to the theory of the black holes. From the Schwarzschild metric, it is easy to show that the Schwarzschild surface is an horizon. But the other properties of the black holes are better studied in using a maximal analytic Schwarzschild extension, as described, for instance, by Kruskal coordinates. In the most general case of a black hole with mass, charge, and rotation, the Penrose-Carter diagrams of the maximally extended metric show an infinite number of topologic regions. This topology raises intriguing possibilities: causality violation, regions with negative values of r and singularities without horizon. (auth)

34115 NON-VIABILITY OF GRAVITATIONAL THEORY BASED ON A QUADRATIC LAGRANGIAN. Bicknell, G. V. (Univ. of Sydney). J. Phys., A (London); 7: No. 9, 1061-1069(11 Jun 1974).

It is shown that physically reasonable solutions of the field equations based on an R^2 lagrangian are possible. (R is the scalar curvature.) However, it is shown that experimental predictions of such a theory are at variance with observations. The most general quadratic lagrangian is also considered, and it is shown that the R^2 term must dominate thus invalidating gravitational equations based on a general quadratic lagrangian. (auth)

34116 GRAVITY-INDUCED ELECTRIC POLARISATION NEAR THE SCHWARZSCHILD LIMIT. Davidson, W.; Efinger, H. J. (Otago Univ., Dunedin, New Zealand). Nature (London); 249: No. 5456, 431(31 May 1974).

It is recognized that electrons have inertia, and recently attention has been paid to the possibility that phenomena may exist that depend on their gravitational mass. It is suggested that stray gravitational fields, such as those encountered in collapsed stellar objects, may give rise to observable electromagnetic effects due directly to the gravitational mass of electric charges. A description is given of an early experiment in which the inertia of electrons was revealed (Tolman and Stewart, Phys. Rev.; 8: 97(1916)) and this is discussed from the point of view of relativity theory. The effect of gravitation on free electrons must influence bound charges in a dielectric, and this may be regarded as gravitational polarization. For the gravitational field of the earth such a polarization has extremely small consequences, but in a collapsed star lying near to its Schwarzschild limit the total vlue of g may be large enough to produce observable effects, especially in conjunction with rapid rotation of the star. Consideration is given to the behavior of a "standard clock" located in intense gravitational fields. (UK)

34117 PERFECTLY CONDUCTING MEDIUM IN GENERAL RELATIVITY. Banerji, S. (Univ. of Burdwan, India). Nuovo Cim.; 23B: No. 2, 345-355(11 Oct 1974).

General-relativistic analogs of some classical theorems and equations of magnetohydrodyamics are found and their relevance to astrophysics is briefly discussed. (auth)

34118 ALGEBRAICALLY SPECIAL METRICS IN THE SOLUTION OF PROBLEMS IN GENERAL RELATIVITY AND GRAVITATION. Sheffield, C. Washington, DC; American University (1973). 104p. University Microfilms Order No. 74-14,248.

Thesis (Ph. D.).

The concept of algebraically special space-times is used to explore the solution of problems in general relativity. A new and elementary analysis is given relating alternate methods of classifying space-times, followed by a systematic analysis and solution of the vacuum field equations for a wide class of algebraically special space-times. Rotating solutions of the nonvacuum case are analyzed in the limit of slow rotation and their application to stellar models is described. (Diss. Abstr. Int., B)

34119 ORIGINS OF THE MODERN THEORY OF GRAVITATION. The Historical Origins of the Theory of General Relativity from 1907–1919. Mehra, J. (International Institutes of Physics and Chemistry, Brussels). Bull. Soc. Roy. Sci. Liege; 43: No. 3-4, 190-213(1974).

Some of the highlights of the history of the creation of general relativity theory are given including steps towards a new theory of gravitation, and Hilbert's theories in the mathematical tradition of Goettingen, the axiomatization of physics, unified theory, and Einstein and Hilbert. (JFP)

34120 OPTICAL METHOD FOR THE RECORDING OF ACOUSTIC AND GRAVITATIONAL WAVES IN THE UPPER ATMOSPHERE. Krasovskii, V. I.; Shagaev, M. V. (Inst. of Physics of the Atmosphere, Moscow). Sov. Phys. - Dokl. (Engl. Transl.); 18: No. 11, 723-724(May 1974).

Translated from Dokl. Akad. Nauk SSSR; 213: No. 3, 553-555 (Nov 1973).

The results of investigations of acoustic and gravitational waves in the upper atmosphere in which three equispaced regions of the sky were scanned at a zenith distance of 60° by means of a spectrograph using the rapid variations of the hydroxyl rotational temperature are reported. (JFP)

34121 CONTRIBUTION TO THE RAINICH THEORY OF THE NEUTRINO FIELD II. Griffiths, J. B. (Loughborough Univ. of Tech., Eng.). Int. J. Theor. Phys.; 9: No. 4, 253-261(Apr 1974).

Conditions are given on the metric of a space-time for it to admit a neutrino-gravitational field. The method described involves comparing the spin coefficients of a suitably defined tetrad of null vectors. It is used to obtain the class of space-times which admits a neutrino field or a non-null electromagnetic field. The classes of space-time which admit two different neutrino fields are also described. (auth)

34122 GRAVITATIONAL ENERGY-MOMENTUM DENSITIES OF ARBITRARY WEIGHT. Wiarda, G. G. (Rijksuniversiteit, Groningen, Netherlands). Int. J. Theor. Phys.; 9: No. 4, 263-267(Apr 1974).

Various familiar expressions for the gravitational energy-momentum complex are derived from a generalized superpotential for arbitrary weight. (auth)

34123 STRESS ENERGY TENSORS IN THE THEORY OF DIRECT INTERPARTICLE ACTION. Narlikar, J. V. (Tata Inst. of Fundamental Research, Bombay). J. Phys., A (London); 7: No. 11, 1274-1282(21 Jul 1974).

It is shown that the canonical tensor and not the Frenkel tensor is the correct tensor to describe the gravitational influence of direct particle fields. This corrects an earlier calculation which had resulted in favor of the Frenkel tensor. The forms of the two tensors are examined in cosmological models with perfect future absorbers and imperfect past absorbers, and it is shown that only the canonical tensor is physically reasonable. (auth)

REACTOR TECHNOLOGY AND REGULATION

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 33044, 34293, 34299, 34307, 34312, 34317, 34319, 34327, 34330, 34331, 34390, 34391, 34396, 34426, 34428, 34431–34433, 34435, 34436, and 34440.

34124 (FRNC-CONF-105) FABRICATION OF FUEL ELEMENTS IN FRANCE. de Lasteyrie, B.; Jeanpierre, G. (Compagnie pour l'Etude et la Realisation de Combustibles Atomiques (CERCA), 75 – Paris (France); Societe Industrielle de Combustibles pour Reacteurs Electrogenes (SICREL), 92 – Le Plessis-Robinson (France)). 1973. 13p. (In French). (CONF-730983-8). Dep. NTIS (U. S. Sales Only) $4.00.

From congress of the Society of Electrical, Electronic and Radio Engineers meeting; Vittel, France (11 Sep 1973).

For the past fifteen years, the main activity of the nuclear fuel industry in France has been the fabrication of fuel for the graphite gas reactor family, carried on by two firms, the SICN and the CERCA. The industry has now entered a new phase, with orders from EDF for its water moderated plants. The problems of fuel fabrication are discussed, as well as those of the industry's restructuring, required to meet the needs of the new market. Two new enterprises have been formed, SICREL and EUROFUEL. The report also describes briefly other fuel fabrication techniques developed in France. (FR)

34125 (OOE-ES-002) DIESEL GENERATOR OPERATING EXPERIENCE AT NUCLEAR POWER PLANTS. Crooks, J. L.; Vissing, G. S. (USAEC Directorate of Regulatory Operations, Washington, D.C.). Jun 1974. 63p. Directorate of Regulatory Operations, Washington, D. C. Free.

Available test and operating experience data are provided for diesel generator units installed as standby electric power supplies in operating nuclear power plants. The data include failures experienced during periodic surveillance tests and during abnormal events in which the standby power system was required to operate automatically. The diesel generator failures experienced during surveillance testing of the units have been tabulated for each operating nuclear plant and classified by manufacturer, by the electrical capacity or size of the diesel generator unit and the component or subsystem initiating the failure. Failure probabilities are computed from these surveillance test data. 20 references. (auth)

34126 (OOE-ES-003) SETPOINT DRIFT IN NUCLEAR POWER PLANT SAFETY-RELATED INSTRUMENTATION. Hartfield, R. A. (USAEC Directorate of Regulatory Operations, Washington, D.C.). Aug 1974. 34p. Directorate of Regulatory Operations, Washington, D. C. Free.

Two-hundred and twenty-two instances of setpoint drift in nuclear power plant protective instrumentation devices were reported as abnormal occurrences from January 1, 1972 through June 30, 1973 by nuclear power plant licensees. These instances were studied to assess their causes and significance. (auth)

34127 (RT/ING-(74)4) PRESSURE DROP CALCULATIONS IN BWR ROD BUNDLES. Marinelli, V.; Pastori, L. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Feb 1974. 89p. (CONF-720686-6; CONF-720607-38). Dep. NTIS (US Sales Only) $8.00.

From European two-phase flow group meeting; Rome, Italy (6 Jun 1972).

Pressure drop calculation methods are reviewed and presented in a form directly applicable to computer codes. The methods are applied to a sample reference case consisting of a BWR fuel element. The calculated results are compared with experimental data from various sources. (DG)

34128 (STI/PUB-194/7) POWER AND RESEARCH REACTORS IN MEMBER STATES. 1974 Edition. (International Atomic Energy Agency, Vienna (Austria)). 1974. 111p. Dep. NTIS (US Sales Only) $8.75. IAEA $5.00.

A comprehensive list of land-based nuclear power and research reactors in the Member States of the International Atomic Energy Agency is presented. The list includes data on all reactors in operation, under construction, and planned. The cumulative electric power generated up to December 1973 is given for operating plants, and the growth of installed capacities of power reactors and the increase in the number of research reactors are illustrated. A reactor name index is included. (DCC)

34129 (TID-26633) CORE THERMAL ANALYSES OF A STAINLESS STEEL CLAD HEATER ROD BUNDLE. Moser, C. M.; Griebe, R. W. (Energy, Inc., Idaho Falls, Idaho (USA)). Dec 1973. Contract AT(10-1)-1457. 31p. Dep. NTIS $4.75.

Core thermal analyses were performed by Energy Incorporated on an 8 × 8 array of stainless steel clad heater rods in order to determine both the final steady state cladding temperatures and the thermal response during a spray only transient using the 6KILER computer code. This study included the effects of the following parameters on the bundle temperature response for the steady state stainless steel analyses: bundle power; rod and canister emissivity; and for the transient stainless steel analyses for rod and canister emissivity. 4 references. (auth)

34130 PLAN FOR DECREASING RADIOACTIVE WASTES FROM NUCLEAR POWER STATIONS. Kuwashima, K. (Kansai Electric Power Co. Inc., Osaka). Genshiryoku Kogyo; 20: No. 1, 20-24(Jan 1974). (In Japanese).

In the first part, quarterly records (covering from March 1970 to March 1973) on the release of liquid and gaseous radioactive wastes to environment from 2 BWRs and 2 PWRs in Japan are presented. The release rate of rare gas from BWRs was remarkably decreased by the installation of rare gas hold-up system. The release rate of liquid waste is also decreasing due to the improvement and reinforcement of management system. In the second part, the present status and future trend of methods for decreasing release rate are reviewed. The guide lines are to hold up rare gases as long as possible and to combine evaporation and demineralization with extended re-circulation of used water. In the third part, the US AEC's evaluation (10 CFR 50) on the decontamination capability of individual treating facilities is introduced. Particularly, the expected efficiency of proposed rare gas disposal systems is discussed both for BWR and PWR. The evaluated values of decontamination factor for demineralizers and evaporators are shown. (JA)

34131 USE OF ACOUSTIC EMISSION TO DETECT INCIPIENT FAILURE IN NUCLEAR PRESSURE VESSELS. Bell, R. L. Nucl. Safety; 15: No. 5, 554-571(1974).

Significant advances in the technology and application of the acoustic-emission phenomenon to detection, location, and characterization of incipient-failure mechanisms in pressure vessels have been made over the last several years. In addition to programs carried out by development laboratories and private research facilities, the government and the utility industry have also sponsored programs that have greatly increased the scope and applicability of the technique to nuclear pressure-vessel inspection. Both periodic hydrotest monitoring with acoustic emission and continuous acoustic-emission surveillance are feasible for application to boiling-water-reactor and pressurized-water-reactor pressure vessels. Both approaches have their limitations and advantages but, in general, appear to provide more information on the integrity of the nuclear pressure vessel than any other nondestructive testing technique presently used. Although research and development work is continuing with regard to better determining the severity of the acoustic-emission sources, considerable field application is already providing useful base-line and operating information. 73 references. (auth)

34132 RECENT OCCURRENCES AT NUCLEAR REACTORS AND THEIR CAUSES. Nucl. Safety; 15: No. 5, 608-613(1974).

The information on reactor occurrences tabulated came from reports received by the Nuclear Safety Information Center at Oak Ridge National Laboratory in May and June 1974. A brief description of each incident is included, along with the reactor, facility, or institution at which the incident occurred. The docket number and the date of the report are included so that interested readers may obtain copies of the reports from the AEC Public Document Room, 1717 H Street, NW, Washington, D. C. Each reactor installation has its own docket number in the filing system at the Public Document Room. (auth)

34133 SELECTED SAFETY-RELATED OCCURRENCES REPORTED IN MAY AND JUNE 1974. Casto, W. R. (comp.) (Oak Ridge National Lab., TN). Nucl. Safety; 15: No. 5, 613-618(1974).

Of the incidents reported during May and June, the following are reviewed because of their uniqueness and/or general interest. Incidents selected for discussion include excessive radiation doses to 40 maintenance workers at the R. E. Ginna plant; a momentary violation of the power limit at the Massachusetts Institute of Technology research reactor (MITR); a turbine trip, reactor shutdown, and actuation of the emergency core-cooling

system (ECCS) caused by poor communications at Zion 2; shutdown of the Browns Ferry reactor due to disturbances on the distribution system caused by a tornado; and failure of a thin-walled valve and subsequent loss of primary coolant at Quad Cities. A nonreactor incident in which an operator may have been lethally exposed to a ^{60}Co source in a hot cell is included for general interest. 11 references. (auth)

34134 SUMMARY OF OPERATION U. S. POWER REACTORS AS OF JULY 1, 1974. Nucl. Safety; 15: No. 5, 619-621(1974).

34135 EXPERIENCE FROM OPERATING AND FUELLING A NUCLEAR POWER PLANT IN AN INDUSTRIALLY DEVELOPING COUNTRY. Dayal, M. (Tarapur Atomic Power Station, India). pp 85-103 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

A description is given of the experience gained during the first refuelling period and from the post-refuelling operation at the Tarapur Atomic Power Station. The refuelling manipulation and the repair work carried out during the first maintenance of the first unit are discussed. Defects to reactor internals and to two brace rods have been observed. The first refuelling and maintenance outage of the first unit had to be extended because of these failures. Both units have also experienced fuel-rod problems owing to cladding defects and, on a number of occasions, the transmission system equipment outside the station had been responsible for some of the outages. The author concludes that the experience gained at the Tarapur Station helped the operating staff to identify various areas of modification and improvement in components, layout, additional facilities etc., which were being continuously implemented and would improve the station's reliability and overall performance. (auth)

34136 EXPERIENCE FROM OPERATION OF OSKARSHAMN UNIT NO. 1. Gimstedt, O. G.; Hilding, S. O. (Oskarshamnsverkets Kraftgrupp AB (OKG), Stockholm). pp 215-229 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The first unit of the Oskarshamn Nuclear Power Station, the first commercial nuclear power plant in Sweden, was connected to the grid for the first time in August 1971. Experience gained during the commissioning and first one and a half years of operation that is of common interest to operators of boiling water reactor plants is reported. During startup the verification of the safety and relief valve function required considerable effort and time because of drift in opening pressure set points. Certain modifications to the valves had to be introduced. During the relief valve testing failures appeared in some anchorages of the blowdown pipes. A redesign of these anchorages was made. During operation a relatively high number of outages have been caused by reactor scrams initiated by unintentional action of the reactor safety systems. Operation conditions and limits established for the functioning of these systems are discussed and the possible redesign presented. The major part of the outage time can be attributed to failures in the turbine plant. Initial operation was disturbed by malfunctioning of the main governor steam valve and unstable flow conditions in the drainage systems for turbine, reheaters, and feedwater heaters. Modifications introduced have proved satisfactory. Fuel performance has been very satisfactory. At the obtained average burnup of 4000 MWd/t only an insignificant leakage has been observed in one single fuel bundle. The background in fuel design and quality assurance measures is discussed. Comparison of fuel performance measurements with reactor physics calculations is presented. The rapid growth of nuclear power plant installations in Sweden has drawn attention to the urgent need for personnel training. In co-operation with other Swedish nuclear power utilities OKG has formed a company (AKU) to evaluate methods and equipment for training nuclear power plant personnel. Self-instructing training material, including various fundamental and special subjects of the nuclear power field, has been developed. The AKU company has also purchased a full-scale BWR simulator which is under construction at Studsvik. (auth)

34137 OSKARSHAMN 1: EXPERIENCE FROM LOAD REJECTION WITH THE ASEA-ATOM BWR. Sterner, T. I. (ASEA-ATOM, Vaesteraas, Sweden). pp 231-242 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

Tests performed with Oskarshamn-1 Power Plant—Sweden's and ASEA-ATOM's first Boiling Water Reactor—confirmed that the ASEA-ATOM BWR design is capable of a full load rejection without seriously perturbing the reactor or any of its auxiliary systems. The actual load rejection was preceded by extensive computer simulations and systems testing during the commissioning of the plant. The load rejection was simulated with the ASEA-ATOM computer code BISON which, together with experimental verification of the dynamics of various control systems and reactor auxiliary systems, showed that rapid and effective measures had to be taken in order to prevent reactor scram. The load rejection in all cases confirmed the conclusions drawn from the computer simulations which had shown that it was necessary to rapidly trip one of the four recirculating pumps. After this was done, the neutron flux immediately decreased, the reactor water level transiently increased 15 cm, and the pressure controller kept the pressure at the desired set point. In the latest ASEA-ATOM BWR design the reactor coolant flow is controlled by internal pumps with submersed motors driven by static frequency converters. This system is insensitive to supply frequency variations and therefore capable of reliably transferring the nuclear power plant to house turbine operation without tripping any pumps. (auth)

34138 ANALYSIS OF THE PERFORMANCE OF THE SYSTEMS AT THE SANTA MARIA de GARONA NUCLEAR POWER PLANT AFTER TWO YEARS' COMMERCIAL OPERATION. Velasco Garcia, E. (Centro Nuclear de Santa Maria de Garona, Burgos, Spain). pp 259-289 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974). (In Spanish).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

On the basis of the experience of two cycles of operation, a study is made of the individual performances of the most important systems, with detailed discussion of the following aspects: (a) faults and how they affected the nuclear safety and/or availability of the power plant; (b) repair of faults, considering difficulties of access, dose intensity and repair time required; (c) periodic tests of the technical specifications, test procedures and test frequency as a function of the results obtained; (d) general and specific design defects; (e) operating difficulties resulting from faulty quality of materials and instrumentation and inadequate availability of equipment; (f) periodic checking of parameters; (g) operating strategy; and (h) the most important anomalies which gave rise to extensive trips and/or transients in the power plant assembly and how they affected the latter's availability. (auth)

34139 SIGNIFICANCE OF PRESENT AND FUTURE OPERATION OF THE KAHL EXPERIMENTAL NUCLEAR POWER STATION (VAK) FOR CONSTRUCTION AND OPERATION OF ECONOMICALLY EFFICIENT NUCLEAR POWER STATIONS. Wolf, M. (RWE-Hauptverwaltung, Essen); Ellmer, M. pp 301-316 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The experimental power station Kahl of the utilities RWE and Bayernwerk, using a 60-MW(th) closed loop, natural circulation BWR, started operation in 1961. For both utilities the purpose of this first Federal German nuclear power plant was to gain experience during erection and operation for application to future large commercial nuclear plants. Because of the experimental character of VAK, a fair degree of flexibility has been built into the original design in order to allow for later modifications. Thus, during the last 12 years of operation valuable experience has been gained in connection with the plant performance itself, and also through experiments with advanced fuel bundles, components and materials. Another very important contribution of VAK to improving nuclear power plant technology resulted from the investigation of several control-rod nozzle failures, which had been recognized by the end of 1971. This investigation and repair work was started immediately despite the estimated high cost and technical difficulties. A 12-months work period gave valuable information on how to prevent and to solve similar potential problems in commercial nuclear power stations. It is hoped that the continuation of the VAK operation will add more information about this type of failure mechanism since additional instrumentation is being used and future particular testing is planned. It is felt that this case of nozzle failure stresses the importance of VAK for gaining long-term

operational experience, and that the future operation of this plant is justified despite the considerable cost involved. (auth)

34140 MAINTENANCE AND IN-SERVICE INSPECTION EXPERIENCE AT LARGE NUCLEAR POWER PLANTS. Bridenbaugh, D. G. (General Electric Co., San Jose, CA); Turner, R. L.; Lloyd, G. B. pp 317-331 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

Beginning with the commercial start-up of Dresden I in August 1960 and continuing through January 1973, there have been 24 General Electric boiling-water reactors (BWRs) in operation around the world, having an installed capacity of over 10 million kilowatts. Over 5 million kilowatts of generating capacity were placed in initial service during the period of 1969 through 1971. Many of these units have been in service long enough to have given a good indication of the performance which can be expected over the long-term operation of the BWR and, in total, have produced well over 100 plant-years of operating experience. Twenty-one of these 24 units have had at least one major refueling and maintenance outage, thereby providing extensive amounts of maintenance experience. Summarization of the more significant results of GE's extensive operation and maintenance experience, along with a discussion of some of the maintenance planning and preparation aspects, ensures utilization of this experience in future outages. (auth)

34141 REPAIRING THE PRIMARY HEAT EXCHANGERS AND A CIRCULATION PUMP AT KERNKRAFTWERK LINGEN (WKL). Deublein, O. (Kernkraftwerk Lingen GmbH (KWL), Lingen, Ger.). pp 353-363 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The steam produced in the Lingen boiling water reactor is transferred to the secondary water loop by two vertically mounted heat exchangers. Each of them contains 5000 straight tubes which are welded between a top and a bottom plate. The primary steam is condensed outside of these tubes, and the condensate is collected by tubes which lead from the bottom plate to a spherical collector located inside the pressurized shroud. During an inspection some cracks were found near the welding joining the condensate tubes into the bottom plates, which were caused by overstressing the tubes. When all the eight collecting tubes were cut away, numerous additional small cracks showed up in the plating of the eight bores. The material was removed by an especially developed lathe adapted to the topology of the heat exchangers. This work took a lot of time since at some places up to 30 mm had to be removed by grinding. About 100 kg of new material was welded on by arc welding with Inconel 182 wires. The new tubes were fastened to the bottom plates by bolts and nuts. The bolt head is supported from the upper side of the bottom plate, and a nut presses the flange to the lower side, seal welds giving the required tightness. Because of the scope and the long time period of this work the doses applied to the personnel totalled about 400 rem. At one of the two circulation pumps (capacity 6000 t/h of water at 870 rpm, head 25 m w.g.) a leakage occurred because of a failure of a gasket and the seal weld, and the expelled steam (7 kg/h) was fed to the containment venting system for a year. The repair work was impaired by a dose-rate of 2.5 rem/h in the compartment. Appropriate shielding reduced the dose-rates at the working positions to 0.1 rem/h. After disassembly the pump wheel was found to give dose-rates up to 40 rem/h at the surfaces. By proper pickling with oxalic and citric acids in alternation with $KMnO_4$ and NaOH at 95°C, a good decontamination factor was reached. Then new gasket rings were installed and the seal weld restored. It took 35 days to do the repair work, and the doses applied to the personnel totalled about 55 rem. (auth)

34142 SIX YEARS' EXPERIENCE WITH CORE PERFORMANCE AT KRB POWER STATION GUNDREMMINGEN. Eickelpasch, N. (Kernkraftwerk RWE-Bayer-Werk GmbH, Gundremmingen, Ger.). pp 449-460 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The KRB power station (BWR, 250 MW(e)) is designed for an average core power density of 40.9 kW/liter, corresponding to a full power linear heat rate of 176 W/cm or 520 W/cm maximum. Actually the plant was operated with maximum heat rates below 410 W/cm. During the whole operating time, especially in the first and fifth cycle, fuel defects caused rather high amounts of fission products in the primary systems. In the first cycle the ^{131}I release rate at the core reached 610 μCi/s, and about 1% of the fuel rods showed failures. In the fifth cycle the ^{131}I release rate reached 1400 μCi/s. Detailed evaluation of some radioisotopes indicative for fuel failures-e.g. ^{131}I, ^{133}I, noble gases, ^{239}Np and ^{99}Tc-allowed certain conclusions on the main type of failures and sometimes on their location in the core. Power shifting by means of special control-rod pattern may reduce the activity release. The method and results of post-irradiation inspections at the plant, i.e. wet sipping, ultrasonic and eddy-current tests and optical means, and in hot cells, are discussed. Predominant types of failures such as oval blisters, cracks, and end-plug defects are investigated in detail. A correlation of failures with power density and exposure of the failed rods can be shown. Failures caused by internal hydriding occurred whenever exposures went below 9000 MWd/t. (auth)

34143 EXPERIENCE WITH FUEL AND CORE PERFORMANCES AT TSURUGA NUCLEAR POWER STATION. Kuge, Y.; Yamazaki, R.; Shinoda, W. (Japan Atomic Power Co., Tokyo). pp 461-476 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

Tsuruga is a single-cycle BWR power plant which began commercial operation in March 1970 with an electrical output of 331 MW(e). Satisfactory plant capability was confirmed through startup testing and the initial six months' commercial operation. The electrical output was then extended to 357 MW(e) as originally planned. Topical fuel and core performances experienced during three years' operation are discussed under refuelling, power distribution, and core reactivity and cycle length. Refuelling was performed three times at the time of annual maintenance outage, and 48, 44 and 84 reload fuel bundles containing gadolinium burnable poison were loaded in a scatter loading pattern which, together with fuel shuffling, optimized core reactivity and maintained shutdown margin. Poison curtains were fully removed during the first refuelling outage. The first shipment of 45 spent fuels to BNFL for reprocessing was successfully performed in March 1973. The maximum linear heat generation rate (LHGR) experienced was about 16 kW/ft, mostly less than 15 kW/ft, and the minimum critical heat flux rate (MCHFR) more than 2.2, mostly around 3.0 based on Hench-Levy correlation. Power distribution is evaluated by both on-line and off-line computers and is controlled by the Haling principle. A gamma scan of fuel was also twice performed which confirmed adequacy of power distribution evaluation. Core reactivity degraded more than expected near the end of cycle-2 and axial power distribution peaked towards the bottom of the core which forced about 20% power derating. The cause of this reactivity shortage is now under investigation and the results will improve the estimate of future cycle length. (auth)

34144 CORE PERFORMANCE AND FUEL-HANDLING OPERATIONS AT TARAPUR. Tirupataiah, T.; Murthy, K. S. N.; Rajaram, R. (Tarapur Atomic Power Station, India). pp 525-543 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

Tarapur Atomic Power Station was commissioned in October 1969, and consists of two reactors, each of about 700 MW(th) capacity. Each core consists of 284 fuel elements with 36 rods of Zircaloy tubes filled with UO_2 pellets. Unit 1 has been refuelled twice so far while unit 2 has been refuelled once. At times the units have been operated at part load because of various problems. During refuelling outages, some cladding defects were determined by sipping methods. Core performance of both the reactors and the fuel behavior are discussed. Fuel burnup and heat flux distribution and their developments with increasing irradiation are discussed along with methods used to obtain optimum overall burnups consistent with peak heat flux requirements. The trend of off-gas activities is presented. The sipping methods and analyses used for determining fuel elements with cladding defects are also discussed and reviewed. Various problems in handling the fuel, poison curtains, neutron monitoring equipment, spacers, etc. were experienced by the operation staff and were successfully resolved. Apart from the refuelling operations, it was necessary to remove and re-install the fuel support plugs and the guide tubes, and perform underwater cutting operations below the bottom grid at a depth of more than 70 ft

in water through an 8-in.-diam. opening. This was due to the peculiar problems of two peripheral guide tubes becoming dislodged, and also because some of the bracing below the bottom grid was severed during reactor operation owing to flow-induced vibrations. The various problems which faced the operators during removal and re-installation of these components are discussed in the paper. (auth)

34145 IN-CORE INSTRUMENTATION AND REACTOR FEEDWATER CONTROL SYSTEMS. Operating Experience at Tarapur. Chalam, K. V.; Mazumder, B.; Mony, P. G. S.; Paranjpe, D. P. (Tarapur Atomic Power Station, India). pp 545-557 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

A system is described which provides accurate measurement and computation of reactor vessel coolant level and maintains it at the desired level, even when the steam output from the reactor vacillates considerably, i.e. by 80%. The requirements of this system are very stringent since the reactor vessel diameter is only 12 ft, and with a change in steam flow of around 900 t/h, it should not touch the trip points of the reactor vessel level, which are 4 ft apart. The basic system comprises twin channels of reactor vessel level measurement, a single channel of feedwater flow and steam flow measurement, and the option of operating a final control valve, either by reactor vessel level alone or by the reactor vessel level properly biased by a difference between feedwater and steam flow for fast action. Problems faced during operation and how they were resolved are discussed. The in-core flux monitoring system has been installed to provide an efficient refuelling, startup, and power run of the twin reactors. The system comprises mainly: (i) Startup of source range flux monitoring system utilized during shutdown, refuelling and startup of the reactor covering a range of flux level from neutron source level to 0.01% of reactor power; (ii) Intermediate range flux monitoring system utilized during startup and shutdown in reactors covering a power range from 0.001 to 12.5% of reactor power; (iii) Local power-range monitoring system giving a continuous indication of the flux profile inside the reactor core ranging from 1 to 125% power; (iv) Traversing in-core probe facility to calibrate the local power range monitors periodically. Problems faced during plant operation and maintenance of the above four systems during normal reactor startup, power run, and refuelling outages of the plant are discussed together with their solutions. (auth)

34146 REACTIVITY BEHAVIOR OF THE DODEWAARD 50-MW BWR CORE BEFORE AND AFTER THE USE OF GADOLINIUM AS BURNABLE POISON. Bruggink, J. C.; Kema, N. V. pp 559-572 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The measured reactivity history of the core as a function of burnup and control-rod pattern is compared with three-dimensional FLARE calculations. The dependence of the thermal power–with constant control-rod pattern or during the derating period–as a function of burnup is compared for the cases without and with gadolinium. The last case is restricted to the cycle started on 24 June 1973 with a fresh fuel loading of 24 elements with Gd_2O_3 as burnable poison and 20 elements without. The total core loading consists of 162 elements. The measured slope–power versus burnup–is about four times less steep than for preceding cycles. (auth)

34147 VERIFICATION OF BWR PHYSICS CHARACTERISTICS FROM WUERGASSEN STARTUP AND RELATED EXPERIMENTS. Kilian, P.; Pleuger, D.; Schulze, J. (Kraftwerk Union AG, Frankfurt am Main). pp 573-588 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

In the startup of the Würgassen power plant some effort has been devoted to verifying the physics design by comparison with theory. The results of these comparisons, as well as earlier experiments from Lingen and Gundremmingen plants, give a good basis for confidence in the accuracy of the calculational procedures. Generally, most contributions should come from existing and operating power plants, whereas other measurements (e.g. critical facilities) can give some guidance, but on the whole they are not so convincing. In Würgassen, the following nuclear properties were measured and checked against theory: (a) Shutdown reactivity of control rods; (b) differential rod worths; and (c) temperature coefficient from cold condition of the reactor to hot standby. The shutdown margin with one control rod out in the cold condition was >1.2% $\Delta\kappa$. This holds for fresh fuel. During burnup this value will decrease to 0.5% $\Delta\kappa$ because of consumption of absorbing boron in the poison curtains. This behavior was checked in the subsequent operation of the reactor (1580 MWd/t at present) and the calculated values were confirmed. Differential reactivity worth of single rods turned out to be near 10% of the calculated values. As expected, the temperature coefficient was negative throughout the whole range. The power distribution was measured by in-core detectors. The effect of control rods on shaping the power distribution was well verified. In the beginning it turned out that there is considerable freedom in maneuvering, and a reduction of the gross peaking factor by approximately 10% could be easily achieved. Additional data from the Lingen operation proved this earlier as well as the Gundremmingen experience. Extensive γ-scanning of the Lingen fuel elements provides further verification of the calculational accuracy in power distribution. Comparison with routine 3D power calculations gives an overall accuracy of better than 5% in bundle power while 10 to 15% deviation in local power density can occur. Würgassen uses the principle of flow control which had been applied in the Lingen reactor for the first time. This gives fast load-following characteristics without changing the power distribution as a whole. This minimizes the load on fuel elements at high power. Before the Würgassen startup the physics experiments were performed in the critical facility. The aims of this experiment were local power distribution in fuel bundles with and without poison curtains; power mismatch factors between fuel bundles with different ^{235}U enrichment; and verification of in-core measuring characteristics. As expected, agreement was good, within 3% of local power. (auth)

34148 SAFETY-RELATED EXPERIENCE IN THE STARTUP PHASE OF THE BWR NUCLEAR POWER PLANT AT WUERGASSEN. Ritter, H. A.; Wiesner, S. (Ministerium fuer Arbeit, Duesseldorf). pp 601-612 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The Würgassen nuclear power plant with a 640-MW BWR was put into operation in October 1971 to perform operational zero power and power tests. The objective of the testing program was to verify the function of all safety-related installations and their simultaneous operation under operational and simulated accidental conditions, this being the most important premise for obtaining a final operating license. Examples of negative experiences to show the importance of an extensive and detailed startup testing program and the necessity of an undelayed evaluation and back-fitting of operational experiences for the overall safety of a large nuclear power plant, as well as the importance of tight authoritative control of the startup phase, are emphasized. During testing of pressure relief valves, the bottom of the suppression chamber was damaged so that a larger leak opened into the drywell. The damage was caused by large pressure pulses due to the rough condensation process at higher water temperature in the suppression chamber. The investigation of this accident involved more detailed knowledge of the processes within the suppression chamber during blow-off of steam, and also of the resulting load to the walls of the suppression chamber. During a search for a leak in the primary circuit, cracks were discovered in a T-joint of one of the main steam lines. This could be attributed to an uncommon dynamic load in the pre-operational phase. Consequently, stronger standards had to be applied to the design of the new T-joint with respect to forces by thermal expansion, operational transients and vibrations. Disturbances in the initiation of the emergency diesels and of the emergency cooling system gave rise to a change in the electric circuits. (auth)

34149 EXPERIENCE FROM OPERATIONAL TESTING PROGRAM INCLUDING ENGINEERED SAFEGUARDS AT TARAPUR. Murthy, K. S. N.; Rajaram, R.; Rao, C. G. C. (Tarapur Atomic Power Station, India). pp 629-641 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

Tarapur Atomic Power Station has two reactors, each of 707 MW(th) capacity and two turbogenerators each capable of generating 210 MW(e). The technical specification calls for a number of functional tests to be done on the reactor protection sys-

tems and the equipment provided for the engineered safeguards of both the reactors. The turbogenerators' protective equipment is also periodically tested. Many of these tests have to be done during reactor operation. Procedures were drawn up during the initial commissioning stage for these various tests and were updated from time to time based on experience gained and problems encountered during 3½ years of operation. The functional test program has helped to detect many of the component failures and circuit defects or calibration drifts in various areas of instrumentation. In a few cases this functional testing also resulted in reactor trips due to equipment/instrument malfunctions and deficiency in the system. The functional testing program at Tarapur, problems faced and the improvements possible and incorporated are described and discussed. The major engineered safeguards systems at Tarapur are: (a) Core spray and containment cooling system; (b) Primary and secondary containment; (c) Emergency ventilation; and (d) Emergency power supplies. Though the various components in the system can be tested periodically, the system as a whole can be tested only during refuelling outages. The performance of the above systems from the commissioning stages to date and the problems encountered and resolved are presented. (auth)

34150 LIGHT-WATER NUCLEAR PLANTS IN THE COMMUNITY: THE PRESENT POSITION AND DEVELOPMENT PROSPECTS. Barazzoni, L.; Colling, A.; Ehrentreich, J.; Nacfaire, H.; Siebker, M. Nukleon; No. 3, 1-16(1972). (In Czech).

The development of design and the future prospects of boiling-water reactors and pressurized-water reactors in the Community are presented, as well as a survey of the experience obtained and a study of the economic aspects and specific capital cost. (Nucl. Sci. Abstr. Czech)

34151 PHYSICAL AND ENERGETIC START-UP OF FIRST BLOCK OF LENINGRAD ATOMIC POWER STATION. Aleksandrov, A. P.; Bulkin, Yu. M.; Dmitriev, I. D. At. Energ. (USSR); 37: No. 2, 99-107(Aug 1974). (In Russian).

After installation the all associated equipment had been completely assembled; actual start-up of the atomic power station was achieved during the period from November 14 to December 21. By May 1974 more than 10^9 kV(t)h electrical energy had been produced. The design of the reactor and its basic characteristics are presented. The sequence of experiments during physical start-up is considered. The stages in start-up of the Leningrad Atomic Power Station are described. (auth)

34152 SAFEGUARDS IN CONNECTION WITH THE TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS. Sitzlack, G.; Schimmel, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin). Kernenergie; 17: No. 7, 239-240 (Jul 1974). (In German).

The existing practice of safeguards is described in connection with the treaty on the non-proliferation of nuclear weapons at the material balance area "Greifswald nuclear power plant 'Bruno Leuschner' " in the German Democratic Republic. (auth)

34153 NUCLEAR SAFETY IN THE GREIFSWALD NUCLEAR POWER PLANT BRUNO LEUSCHNER. Sitzlack, G.; Schimmel, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin). Kernenergie; 17: No. 7, 230-232(Jul 1974). (In German).

The principles of nuclear safety at the Greifswald nuclear power station "Bruno Leuschner" are described. On the basis of siting, type of facility, and experiences gathered during operation of the first nuclear power plant of the German Democratic Republic in Rheinsberg since 1966 an assessment is made of the nuclear safety in the Greifswald nuclear power plant. (auth)

34154 STRUCTURE AND PROSPECTIVE EVOLUTION OF THE MAINTENANCE SYSTEM OF THE GREIFSWALD NUCLEAR POWER PLANT BRUNO LEUSCHNER. Sturm, A. (VEB Kernkraftwerk, Greifswald, Ger.). Kernenergie; 17: No. 7, 232-234 (Jul 1974). (In German).

Maintenance system arrangements in the Greifswald nuclear power plant "Bruno Leuschner" began five years before starting up its first unit. Thus, at the start-up date of the first unit maintenance teams familiar with the plant and prepared for their tasks were available. The principles of organizing management of maintenance works, training and composition of maintenance personnel are discussed. Maintenance works concerned with the Greifswald nuclear power plant "Bruno Leuschner" are summarized by information about temporary workshops during start-up period, order of magnitude of the designed workshops, and the evolution of maintenance capacity when all the designed stages of construction will be finished. (auth)

34155 NUCLEAR FUEL SUPPLY OF THE GREIFSWALD NUCLEAR POWER PLANT BRUNO LEUSCHNER. Gruellich, G. (Inst. fuer Kraftwerke, Berlin). Kernenergie; 17: No. 7, 234-236(Jul 1974). (In German).

The importance of nuclear fuel supply and the principles of a reliable supply of the Greifswald nuclear power plant "Bruno Leuschner" are discussed. The fuel assembly is briefly described. (auth)

34156 TRAINING OF THE PERSONNEL FOR THE FIRST BLOCK OF THE GREIFSWALD NUCLEAR POWER PLANT BRUNO LEUSCHNER. Schoenherr, A. (VEB Kernkraftwerk, Greifswald, Ger.). Kernenergie; 17: No. 7, 236-238(Jul 1974). (In German).

An essential task during preparation of nuclear plant operation is the opportune and high-grade training of operating and maintaining personnel. The composition of personnel of the Greifswald nuclear power plant "Bruno Leuschner" first block is given with respect to qualification and occupational experience during the period before the plant was started up. Starting from the requirements on operating and maintaining personnel, the main phases of training in USSR and GDR factories are presented. As a first experience the assessment is made that the medium-grade managing personnel for operation and maintenance has to be engaged two years before the plant is connected to the mains for the first time, skilled operating and maintaining workers 1 to 5 years before this date. (auth)

34157 SITE AND TERRITORIAL INTEGRATION OF THE GREIFSWALD NUCLEAR POWER PLANT BRUNO LEUSCHNER. Fischer, R. (VEB Kernkraftwerk, Greifswald, Ger.). Kernenergie; 17: No. 7, 189-191(Jul 1974). (In German).

A general review is given of criteria which, among other factors, were responsive for erecting the nuclear power plant near Greifswald. In particular, a description of the site of the nuclear power plant and its retroactions to the territorial drainage area and to the town Greifswald are dealt with. (auth)

34158 MASTER PLANNING, MASTER PLAN, AND DESCRIPTION OF ESSENTIAL SECONDARY TECHNOLOGICAL UNITS OF THE GREIFSWALD NUCLEAR POWER PLANT BRUNO LEUSCHNER. Rambusch, K.; Strehober, W. (VEB Kombinat Kraftwerksanlagenbau, Berlin). Kernenergie; 17: No. 7, 192-200(Jul 1974). (In German).

Master planning is described with special regard to the development of transport, direction of construction, supply of water coolant, and power conduction. The master plan of the Greifswald nuclear power plant is presented, especially the arrangement and association of the individual units. The technological solutions and arrangement of essential auxiliary technological plants are discussed. (auth)

34159 ERECTION AND START-UP OF THE FIRST UNIT OF THE GREIFSWALD NUCLEAR POWER PLANT BRUNO LEUSCHNER. Rambusch, K.; Strehober, W. (VEB Kombinat Kraftwerksanlagenbau, Berlin). Kernenergie; 17: No. 7, 222-230(Jul 1974). (In German).

Arrangement, sections, and principal functional relationships of site organization as well as the arrangement of the large hoisting units are briefly discussed. After presenting the managing system of start-up works of the block, the main stages of preparing and performing the start-up works are given. The extent of the experiments and functional tests is described. (auth)

34160 NUCLEAR POWER ARRIVES. Hilding, S. O. (Oskarshamnsverkets Kraftgrupp AB, Stockholm). ERA (Foeren. Elek. Ration. Anvaendning); 46: No. 5, 93-94(1973). (In Swedish).

Oskarshamn is the first nuclear power station in Sweden to become operational. The first year's operating experience is reviewed briefly. Availability since September 1972 has been 100% (460 MW) for most of the time. (SW)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 34124–34126, 34128, 34130–34134, 34150, 34183, 34289–34296, 34313, 34314, 34317, 34325, 34330–34332, 34390, 34391, 34427, 34429, 34430, 34434, and 34440.

34161 (BNL-19158) CORROSION OF STEAM GENERATOR TUBING IN OPERATING PRESSURIZED WATER REACTORS. Weeks, J. R. (USAEC Directorate of Licensing, Washington, D. C.). 1974. 24p. (CONF-741013-2). Dep. NTIS $4.50.

From 146th meeting of the Electrochemical Society; New York, New York, USA (13 Oct 1974).

Corrosion of steam generator tubing has been observed in all but three PWR's that have been in operation for more than one year. The history of this experience with both stainless steel and Inconel-600 tubing is reviewed. Both intergranular stress corrosion cracking and localized, transgranular wastage have

been observed with Inconel-600 tubing. The wastage can be attributed to a localized concentration, or "hideout" of phosphates in limited flow areas. A model is proposed for this wastage phenomenon which is consistent with operating experience. 33 references. (auth)

34162 (CENPD-107(Rev.01)) CESEC: DIGITAL SIMULATION OF A COMBUSTION ENGINEERING NUCLEAR STEAM SUPPLY SYSTEM. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Jun 1974. 41p.

The computer program entitled "CESEC" provides a digital simulation of the Nuclear Steam Supply System (NSSS) and is used in the safety analyses performed by Combustion Engineering. A partial list of the dynamic functions synergistically included in this NSSS simulation is: point kinetics neutron behavior, Doppler and moderator reactivity feedback, boron and CEA reactivity effects, multi-node average and hot channel reactor core thermal hydraulics, reactor coolant pressurization and mass transport, reactor coolant system safety valves, steam generation, steam generator water level, main steam system bypass, safety and turbine valves, as well as alarm, control, protection, and Engineered Safety Feature Systems. The steam turbine and its associated controls are not included in the simulation. During the course of execution, this FORTRAN IV program obtains steady state and transient solutions to the set of equations which mathematically describe the physical models of the several subsystems mentioned above. Simultaneous numerical integration of a set of nonlinear, first-order differential equations with time-varying coefficients is carried out by means of a predictor corrector Runge-Kutta Scheme. As the time variable evolves, edits of the principal system parameters are printed at prespecified intervals. An extensive library of the thermodynamic properties of water is incorporated into this program. Through the use of CESEC, symmetric and asymmetric plant responses over a wide range of operating conditions can be determined. 7 references. (auth)

34163 (CENPD-116(Rev.1)) DENSIFICATION OF COMBUSTION ENGINEERING FUEL. Andrews, M. G. (comp.). (Combustion Engineering, Inc., Windsor, Conn. (USA)). May 1974. 122p.

Experimental fuel densification information obtained by C-E from irradiations at Yankee Rowe, the Battelle Research Reactor, Palisades, and the Halden Test Reactor was used to establish the parameters important to the production of dimensionally stable fuels. The experimental results are sufficient to demonstrate that the manufacturing modifications applied by C-E have been effective in reducing the extent of densification. The densification kinetics data obtained from the study were used to supplement existing results from which an empirical expression for the dependence of densification on burnup could be derived. In addition, archive pellets from various experimental batches of pellets were used to establish a thermal resintering test as a predictor of in-pile densification. A summary of the most important results of the study is given. (auth)

34164 (CENPD-139(Rev.1)) C-E FUEL EVALUATION MODEL TOPICAL REPORT. (Combustion Engineering, Inc., Windsor, Conn. (USA)). 1 Jul 1974. 246p.

A fuel evaluation model is proposed to provide an analytical method of predicting fuel pellet temperature, fuel rod internal pressure, stored energy, and pellet/clad gap conductivity. The model is based on experimental data for various as-fabricated properties, core lifetimes, and linear heat generation rates. Results of the analysis are used to determine fuel rod fill gas pressure and are used as input to various safety analysis studies. The analytical fuel thermal performance model and the experimental data used to develop that model are described, and means of comparison of predicted performance with actual performance for applicable cases is provided. Input parameters and assumptions are described, and correction factors applied to account for fuel pellet densification and clad collapse are discussed. The interfaces between the Fuel Evaluation Model analysis and safety analysis are indicated. (auth)

34165 (CONF-741017-7) SMALL PWR FOR INDUSTRIAL ENERGY. Klepper, O. H. (Oak Ridge National Lab., Tenn. (USA)). 1974. 6p. Dep. NTIS $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

The 313 MW(t) CNSG reactor being developed by Babcock and Wilcox for commercial ship propulsion was chosen as the basis for the present application study. The reactor is essentially based on current technology and it is developed in sufficient detail to permit economic evaluations. Three approaches for providing process energy were evaluated: electrical energy only, 91 MW; steam only; and a combination of electrical power and steam. A conventional land-based plant as well as a barge-mounted concept were studied. (auth)

34166 (DLCS-5000274) SHIPPINGPORT ATOMIC POWER STATION. Quarterly Operating Report, Second Quarter 1974. (Duquesne Light Co., Shippingport, Pa. (USA)). [nd]. Contract AT-11-1-292. 10p. Dep. NTIS $4.00.

During the second quarter of 1974, the Shippingport Atomic Power Station remained shutdown for main unit turbine repairs and in preparation for refueling. The BD Core Removal Cooling System was in service to the 1B reactor coolant loop during the quarter. The average coolant temperature was maintained at approximately 125°F. There were no major operational incidents during this quarter. The reactor pit dewatering operation was completed on June 15 to permit removal of the reactor chamber dome. Reactor chamber dome removal was accomplished on June 21. The blowoff tank, flash tank and the RWD vent gas system gaseous volume was discharged on May 20 to permit maintenance and overhaul of components during the refueling period. During the second quarter period 2925 cubic feet of radioactive solid waste were shipped off-site for burial. These shipments contained 0.6 curie of radioactivity. (auth)

34167 (EUR-5002) TRINO VERCELLESE NUCLEAR POWER PLANT RESEARCH PROGRAMME FOR THE DEVELOPMENT OF CLOSED-CYCLE WATER REACTOR TECHNOLOGY. Final Technical Report. (Commission of the European Communities, Luxembourg). Sep 1974. 143p. Dep. NTIS (US Sales Only) $10.25. B.Fr. 185.-.

Work completed on the following tasks is reported: Task 1: to develop a zero-dimensional calculation model to study the core reactivity behavior in various operating conditions. Task 2: to study the effect of main coolant pH changes on reactivity and on power and temperature reactivity coefficients. Task 3: to develop a neutron noise technique for the surveillance of reactor vessel internal structures. Task 4: to determine the gamma activity distribution among the fuel assemblies in order to evaluate fuel burnup and/or end-of-cycle power distributions. Task 5: to study the behavior of the steam generators at various power levels and in different operating conditions in order to determine the steam generator ultimate capability. Task 6: to determine the significant core physics characteristics in various operating conditions with the aim of providing a check of the calculating techniques. Task 7: to determine the content of heavy isotopes in the fuel as function of burnup, initial enrichment, and neutron spectrum; to determine fuel burnup; to check the accuracy of calculating methods. (auth)

34168 OPERATING EXPERIENCE WITH SAN ONOFRE NUCLEAR GENERATING STATION. Ottoson, H. L.; Gould, W. R. (Southern California Edison Co., San Clemente). pp 151-166 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The San Onofre Unit One Nuclear Generating Station has been in commercial operation since 1 January 1968. Operating and refuelling experience, including three refuelling outages, is discussed. Experience gained in these refuellings has resulted in a definition of recurring problems and a generalized approach to planning. An In-Service Inspection Program has been instituted at the plant. Unique problems have arisen in defining the scope of this program since San Onofre was constructed before ASME section XI was issued in 1971. Steam generator failures are a generic problem currently involving a number of pressurized water reactors. San Onofre has completed a significant surveillance and repair program during the most recent refuelling outage. This program included eddy-current testing, plug gaging, tube cutting and removal and inspection of anti-vibration bars. The failures and anomalies discovered thus far have been characterized as unique to San Onofre. Nevertheless, it is felt that the problems warrant investigative analysis at other facilities. The preliminary verdict concerning San Onofre Unit 1 steam generators is reviewed. Several significant turbine-generator problems have developed. A steam dump system is being installed to mitigate turbine-generator overspeed transients following a unit trip under certain conditions. Failure of the first reaction stage of the high-pressure turbine was discovered during the second refuelling. The subsequent cycle was negotiated without this stage and replacement of this blading together with other high-pressure turbine repairs proved to be the pacing refuelling outage items during the third refuelling. Another turbine system problem has involved performance of the re-heater system. A number of tube failures have resulted in several outages throughout the past several years. The failures and deficient performance made it necessary to replace tube bundles and separate the tube-bundle

drain system on each train. Operating experience is related and the theorized reason for failure discussed. Other items of interest cover pressurizer safety valve performance, a fuel evaluation program including a plutonium recycle demonstration, integrated containment leak-rate testing and significant plant modifications. Also, escalation of plant manning requirements since commercial operation is discussed. (auth)

34169 FIFTEEN YEARS IN NUCLEAR POWER. Billingham, R. (Westinghouse Electric Nuclear Energy Systems, Europe Inc., Brussels). pp 169-205 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

A compilation of several papers presented at the Symposium reports on some of the experience gained during the past fifteen years from the many Westinghouse-designed commercial nuclear power plants now in operation. The report covers fuel performance, the performance of some major components, and fuel and waste-handling systems performance and development. (auth)

34170 EXPERIENCE FROM OPERATION OF STADE NUCLEAR POWER PLANT DURING FIRST FUEL CYCLE AND FIRST REFUELLING. Goetz, A. (Nordwestdeutsche Kraftwerke AG, Stade, Ger.). pp 207-213 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The Stade Nuclear Power Plant is the first Federal German pressurized water reactor operated on a commercial basis. After a four-year construction period the first fission chain reaction was initiated on 8 January, 1972. An initial series of startup tests followed, and upon a satisfactory completion of four weeks' trial operation with full power, KKS took over control of the plant. Since then the plant has worked nearly continuously with full power and achieved an availability of more than 80%. At the end of May 1973 an electrical output of 5.5×10^9 kWh was reached. The average burnup will be around 14 100 MWd/tU at the end of the first cycle. The radioactive releases of gaseous and liquid effluents to the environment has remained far below the established limits. Experiences with the whole plant and particular components during the operation period and first refuelling are described. (auth)

34171 OPERATING EXPERIENCE OF THE ARDENNES NUCLEAR POWER PLANT. Marchal, A. (Societe d'Energie Nucleaire Franco-Belge des Ardennes, Chooz, France). pp 243-258 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The Ardennes Nuclear Power Plant has just completed its second year of industrial-scale operation after the major incidents which followed its startup. Apart from the yearly shutdowns for refuelling, availability has been very high–96% in 1971 and 97% in 1972. Studies and tests have shown that the rated power can be increased by 10%. The organization and various activities of the plant and the principal technical problems encountered are described. In an effort to reduce production costs, bids have been invited for the supply of fuel. The doses to which personnel are exposed and the effects of gaseous and liquid wastes on the environment are also discussed. (auth)

34172 OPERATION PERFORMANCE OF STEAM GENERATORS AND CIRCULATION PUMPS IN THE PRIMARY CIRCUIT OF THE OBRIGHEIM NUCLEAR POWER PLANT (KWO). Mayr, A. (Obrigheim Nuclear Power Station, Ger.). pp 333-341 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The Obrigheim Nuclear Power Plant has been in normal operation for four years. The experience gained from problems that arose from malfunctioning of the steam generators and main coolant pumps, and the difficulties involved in maintenance and inspection are summarized. (auth)

34173 ACTIVITY DUE TO CORROSION PRODUCTS IN THE PRIMARY CIRCUIT OF THE ARDENNES NUCLEAR PLANT. Frejaville, G. (CEN, Fontenay-aux-Roses, France); Marchal, A.; Beslu, P.; Lalet, A. pp 401-418 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

During the refuelling shut-downs of the Ardennes nuclear plant (Chooz) in June 1971, 1972, and 1973, experiments were carried out in order to: Investigate the rise in primary-water activity accompanying the reactor shut-down; Measure the activity deposited on the primary-circuit walls. The results of these experiments, studied in comparison with other results obtained from the same reactor, have improved the knowledge of phenomena governing the movement of corrosion products. These results are compared with the values obtained by the calculation code developed by the Commissariat à l'Energie atomique. (auth)

34174 EXPERIENCE FROM FUEL PERFORMANCE AT THE OBRIGHEIM NUCLEAR POWER PLANT (KWO). Schenk, H. J. (Obrigheim Nuclear Power Station, Ger.). pp 435-448 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

Core design and design criteria are discussed, and reactivity behavior of the first four fuel cycles is described. Data on axial and radial power density, fuel utilization, and primary coolant activity are presented. Fuel rod failures are also discussed. (DG)

34175 IMPROVEMENT OF WASTE DISPOSAL SYSTEM. Kondo, K.; Aoki, K. (Mitsubishi Atomic Power Industries, Inc., Tokyo). Karyoku Genshiryoku Hatsuden; 25: No. 1, 43-46(Jan 1974). (In Japanese).

In the effort to cope with the radioactive gas produced in coolant for PWR plants, the system of removing the gas such as Xe and Kr out of coolant water has been developed; which utilizes Pd alloy diaphragm for hydrogen purification. The principle is that while hydrogen gas passes through the diaphragm, other gases contained in it are retained. The removing unit consists of one-end closed pipes extending from a tube plate. Mixed gas flows outside the tubes, and hydrogen flows out of the side of the tube plate through tube wall; whereas other gases flow along the outer surface of the tubes. The whole system comprises an ordinary volume control tank, the gas-removing unit, a hydrogen tank, and a gas-radioactivity decay tank. The system features the recirculation of the hydrogen gas, no need for the oxygen to combine with hydrogen, and small size of the storage decay tank. (JA)

34176 THE NUCLEAR UNIT OF THE BIBLIS NUCLEAR POWER STATION. Huttach, A.; Putschoegl, G.; Ritter, M. (Kraftwerk Union A. G., Erlangen (F.R. Germany). Reaktortechnik). Atomwirt., Atomtech.; 19: No. 8/9, 420-430(Aug 1974). (In German).

10 figs.; 1 tab.; 3 refs.

All the modifications made in the nuclear unit of Biblis nuclear power plant as compared with the plant's predecessors have been made in accordance with the experience gained with the preceding plants, or in order to meet new, more stringent requirements with regard to reactor safety. The construction and mounting of the plant has been characterized by extensive checking programs, their main purpose being to ensure reproducibility of results for future use in in-service inspections. Great emphasis has also been placed on the definition and determination of the criteria and problems to be considered in the analysis of design basis accidents. (GE)

34177 CONCERNING THE SELECTION OF OPTIMUM UNITS FOR A NUCLEAR POWER PLANT FOR HEAT SUPPLY. Arsenjev, Ju. D.; Bereza, Ju. S.; Voronkov, M. E.; Muchanov, S. I. Arch. Energiewirt.; 28: No. 15, 760-767(Aug 1974). (In German).

4 figs.; 14 refs. Also issued in At. Ehnerg. (1974) v. 36, p. 174-177.

The criteria are given upon which the selection of pressure data for the coolant of a nuclear-powered district heating plant with Soviet PWRs is based, as these data are determined by the technical and economic features of the thermal plant. The possible increase of thermal power of the reactor is described and compared with that of a nuclear power plant reactor. The dependence of the optimum enrichment of the fuel of a nuclear thermal power plant on the cost of natural uranium and the expenditures for nuclear fuel fabrication is calculated. (GE)

34178 DRUCKWASSERREAKTOREN FUER KERNKRAFTWERKE. (Pressurized Water Reactors for Power Plants). Oldekop, W. (ed.). Thiemig-Taschenuecher, Band 51. Munich; Verlag Karl Thiemig (1974). 349p. DM 28,80.

A collection of 14 articles on various aspects of PWR is compiled. The topics discussed include the general characteristics of PWR, their physical nuclear characteristics, heat and flow characteristics, construction of the reactor core, construction of the primary circuit components, construction materials of the primary circuits, fuel cycle and fuel costs, nuclear engineering aspects, instrumentation and control, reactor incidents and safety, safety engineering in reactors, operational experiences with PWR, the Biblis reactor plant as an example of the application of modern power technology in reactor power plants with PWR, and future development trends. (JSR)

34179 STANDARDIZING (LIMITING) THE SILICA CONTENT OF THE WATER IN THE SECONDARY LOOP OF NUCLEAR STATION STEAM GENERATORS WITH WATER-MODERATED WATER-COOLED REACTORS. Martynova, O. I.; Churikova, L. P. (Moscow Power Inst.). Therm. Eng. (USSR) (Engl. Transl.); 20: No. 10, 131-134(Oct 1973).

Translated from Teploenergetik; 20: No. 10, 89-91(1973).

An experimental study to establish the limiting allowable concentration of silicate ions in the water of steam generators of water-cooled and -moderated nuclear power plants is reported. (JWR)

34180 ONCE-THROUGH STEAM GENERATOR: OCONEE-1 OPERATION. Bertolotti, G.; McDonald, B. N.; Michaud, E. R. (Babcock and Wilcox Co., Lynchburg, VA). Energ. Nucl. (Milan); 21: No. 8-9, 484-494(1974).

From 19th nuclear congress; Rome, Italy (21 Mar 1974).

The first full-sized units of the Babcock & Wilcox OTSG (Once-Through Steam Generator) design have been operated over their load range. Data from the first Oconee unit are presented. Comparison of full-sized unit operating data with earlier laboratory results is presented. It is concluded that the thermal and hydraulic performance of the OTSG achieved at Oconee is as good as or better than expected, and that its controllability and response during both normal and emergency transients have been excellent. (auth)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 31719, 32739, 32891, 34124, 34128, 34132, 34134, 34303, 34309, 34318, 34325, and 34437.

34181 (BNWL-331) COMPUTER CALCULATION OF REACTOR GRAPHITE OXIDATION. Giberson, R. C.; Oster, C. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1967. Contract AT(45-1)-1830. 84p. Dep. NTIS $7.25.

Declassified 9 Oct 1974.

Graphite oxidation in a graphite-moderated reactor depends on the composition and flow rate of the gas atmosphere, graphite temperature, and geometry of the system. Graphite oxidation, by water vapor or carbon dioxide, in a given system is complicated because of possible inhibition of the oxidation reactions by species such as H_2 and CO and also because gas-phase reactions affect the concentrations of the various gases. Furthermore, diffusion effects in gas-solid reactions must be considered. A computer program is described in which the rate of graphite oxidation is calculated for a variety of geometrical configurations, and temperature profiles. Chemical reactions involving the gaseous species H_2O, CO_2, CO, H_2, and O_2 are treated. Other chemical reactions involving additional species, such as CH_4, can readily be added to the program, which is limited primarily by the lack of knowledge of reaction mechanisms and rate constants. The program will be illustrated by its application to a low flow, atmospheric pressure oxidation system. However, with relatively minor modifications the program can be adapted to a high flow, high pressure system as in the HTGR. (8 references) (auth)

34182 (CONF-730465-(P2)) PROCEEDINGS OF INTERNATIONAL SYMPOSIUM ON VIBRATION PROBLEMS IN INDUSTRY, KESWICK, ENGLAND, 10-12 APRIL 1973. Session 2. Weightman, P. (ed.). (UKAEA Reactor Group, Sellafield; National Physical Lab., Teddington (UK)). 1973. 315p. Dep. NTIS (US Sales Only) $18.75.

Fifteen papers are presented concerning acoustic vibration problems. Ten of the papers have been previously abstracted and included in NSA. These papers can be found under the following abstract numbers in Volume 29 of NSA: 31172, 31176, 31174, 31391, 31173, 31175, 31211, 31210, 31209, and 31407. (DCC)

34183 (CONF-730465-(P5)) PROCEEDINGS OF INTERNATIONAL SYMPOSIUM ON VIBRATION PROBLEMS IN INDUSTRY, KESWICK, ENGLAND, 10-12 APRIL 1973. Session 5. Weightman, P. (ed.). (UKAEA Reactor Group, Sellafield; National Physical Lab., Teddington (UK)). 1973. 259p. Dep. NTIS (US Sales Only) $16.00.

Fourteen papers are presented concerning fuel elements for AGR-type reactors and structural response of reactor components. All fourteen papers have been previously abstracted and included in NSA. The papers can be found under the following abstract numbers in Volume 29 of NSA: 31180, 31181, 31182, 31183, 31179, 31184, 29240, 29241, 31178, 31212, 31214, 31213, and 31158. (DCC)

34184 (EUR-5147e(Pt. 1)) FIRST JOINT 900°C HTR FUEL IRRADIATION EXPERIMENT IN THE HFR PETTEN PROJECT E 96-01. Irradiation History. Roettger, H. (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). 1974. 50p. Dep. NTIS (U. S. Sales Only) $5.50.

Coated particles in monolayers and compacts were irradiated in the HFR Petten at about 900°C for about 72 days. In this period a maximum fast fluence of $1.2.10^{21}$ cm^{-2} DNE and a peak burn-up of 7.4% FIMA were reached for 12% enriched U-fuel. During irradiation the R/B-value remained at 10^{-7} for Kr-85m and at $2.5.10^{-6}$ for Xe-133 which is relatively small. Irradiation was terminated by a serious leakage of the irradiation device. Visual inspection of the samples after dismantling showed that no monolayer or compact was broken. (auth)

34185 (EUR-5147e(Pt. 2)) FIRST JOINT 900°C HTR FUEL IRRADIATION EXPERIMENT IN THE HFR PETTEN PROJECT E 96-01. Post-Irradiation Examination. Drago, A.; Van Raaphorst, J. G. (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). 1974. 67p. Dep. NTIS (U. S. Sales Only) $6.50.

An irradiation experiment has been executed in the HFR reactor at Petten to investigate the performance of a large variety of HTR fuel over a range of burn-up and fast neutron doses with fuel surface temperatures of about 900°C. The results of post-irradiation examination are presented together with some remarks and suggestions in order to improve the fuel performance and reduce production costs. (auth)

34186 (GA-A-13004) POSTIRRADIATION EXAMINATION OF PEACH BOTTOM FUEL TEST ELEMENT FTE-3. Wallroth, C. F.; Baldwin, N. L.; Scott, C. B.; Zumwalt, L. R. (General Atomic Co., San Diego, Calif. (USA)). 15 Aug 1974. Contract AT(04-3)-167. 207p. Dep. NTIS $7.60.

FTE-3 was a phase II fuel test element in Peach Bottom Unit 1, Core 2. Beginning-of-life (BOL) for phase II was 252 equivalent full-power days (EFPD) of Core 2 operation. FTE-3 was irradiated for 133 EFPD, accumulating a fast fluence of 0.6×10^{21} n/cm^2 (E > 0.18 MeV) and a thermal fluence of 0.66×10^{21} n/cm^2 (E < 2.83 eV) at an irradiation average peak fuel temperature of 913°C. Calculated peak burnup was 11.3% fissions per initial metal atom (FIMA) for fissile and 0.057% FIMA for fertile material. After removal from the core, the element was γ-scanned for fuel stack length determination. It was then shipped to the Hot Cells of General Atomic Company, San Diego, California, for postirradiation examinations. No failure of graphite and fuel components was found. Although FTE-3 had a short irradiation exposure, the results on dimensional changes, especially on fuel rods, are considered to be most valuable because the large number of samples provided statistical confidence for improvement of computer code models near start-of-life conditions. Evaluation of fuel rod and graphite dimensional measurements also allowed determination of integral gap behavior, which is valuable for heat transfer and interaction considerations. The hot injected fuel rods can be split into four different blends with all TRISO and TRISO/BISO fissile-fertile fuel. All four blends have been inspected destructively and nondestructively for failure determination by fission gas annealing, metallography, and the electrolytic disintegration-acid leach technique. A coated particle failure of less than 1.0% was determined from these examinations. 16 references. (auth)

34187 (GA-A-13030) HTGR BASE PROGRAM. Quarterly Progress Report for the Period Ending May 31, 1974. (General Atomic Co., San Diego, Calif. (USA)). 28 Jun 1974. Contract AT(04-3)-167. 299p. Dep. NTIS $7.60.

Progress in the base technology of the High-Temperature Gas-cooled Reactor (HTGR) system is reported. Included are studies of basic fission-product distribution mechanisms, recycle fuel studies, exploration of head-end reprocessing methods, and physics and fuel management studies. Materials studies include irradiation and analysis of fuel particles in capsules to evaluate fuel systems, and basic studies of control materials and of carbon and graphite. Experimental procedures and results are discussed and data are presented. (auth)

34188 (GA-A-13058) PUBLIC SERVICE COMPANY OF COLORADO 330-MW(e) HIGH-TEMPERATURE GAS-COOLED REACTOR RESEARCH AND DEVELOPMENT PROGRAM. Quarterly Progress Report for the Period Ending June 28, 1974. (General Atomic Co., San Diego, Calif. (USA)). 31 Jul 1974. Contract AT(04-3)-633. 38p. Dep. NTIS $4.00.

The research and development program for the Public Service Company of Colorado 330-MW(e) High-temperature Gas-Cooled Reactor is reviewed. Studies of nuclear analysis and startup test are presented. The fuel development and fuel element proof testing portions of the report include demonstration testing of the performance of test fuel elements by means of irradiation at expected operating temperatures and capsule irradiation tests of production fuel. Studies covering the components of the steam generator under operating conditions are included. (auth)

34189 (NP-20157) INTERNUCLEAR 3 (TI51) TUBULAR INTERACTING EXPERIMENT. Final Report. Gaube, M. (Societe Belge Pour l'Industrie Nucleaire, Brussels). Aug 1974. 46p. (BN-7408-02). Dep. NTIS (US Sales Only) $5.50.

Internuclear 3 is one of a series of irradiation experiments in the Dragon reactor designed to simulate as closely as possible the operating conditions of the tubular interacting fuel pin, which was chosen by Internuclear as the reference fuel design for the HTR. Post-irradiation examinations carried out at Winfrith and Saclay on fuel irradiated from June 1971 to November 1972 are described. The fuel had reached an estimated peak fast neutron dose of 1.3×10^{21} DNE n/cm^2 and an estimated peak burnup of 4.9% FIMA. (auth)

34190 (ORNL-TM-4477) FABRICATION OF ORNL FUEL IRRADIATED IN THE PEACH BOTTOM REACTOR AND POST-IRRADIATION EXAMINATION OF RECYCLE TEST ELEMENTS 7 AND 4. Long, E. L. Jr.; Fitts, R. B.; Homan, F. J. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 71p. Dep. NTIS $5.45.

Seven full-sized Peach Bottom Reactor fuel elements were fabricated in a cooperative effort by Oak Ridge National Laboratory (ORNL) and Gulf General Atomic (GGA) as part of the National HTGR Fuel Recycle Development Program. These elements contain bonded fuel rods and loose beds of particles made from several combinations of fertile and fissile particles of interest for present and future use in the HTGR. The portion of the fuel prepared for these elements by ORNL is described in detail. A fabrication description of the test is provided in addition to the results obtained to date from postirradiation examination of the first two elements removed from the Peach Bottom Reactor, RTE-7 and -4. The fuel examined had relatively low exposure, up to about 1.5×10^{21} neutrons/cm^2 fast (>0.18 MeV) fluence, compared with the peak anticipated HTGR fluence of 8.0×10^{21}, but it has performed well at this exposure. Dimensional data indicate greater irradiation shrinkage than expected from accelerated test data to higher exposures. This suggests that either the method of extrapolation of the higher exposure data back to low exposure is faulty, or the behavior of the coated particles in the neutron spectrum characteristic of the accelerated tests does not adequately represent the behavior in an HTGR spectrum. (auth)

34191 (ORNL-TM-4554) PERFORMANCE OF CANDIDATE HTGR FUELS IN FUEL ROD IRRADIATIONS IN HFIR. Scott, J. L.; Conlin, J. A.; Coobs, J. H.; Eatherly, W. P.; Homan, F. J.; Long, E. L. Jr. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. Contract W-7405-eng-26. 25p. Dep. NTIS $4.00.

Experience has shown that the most valid test for HTGR fuels is one in which the fuel particles are bonded into a matrix and tested with temperatures and temperature gradients simulating those which will exist in the real reactor. A series of tests was conducted in the removable beryllium positions of the High Flux Isotope Reactor (HFIR) in which the above criteria were met. Although the original purposes of the tests varied, some insight was gained on the performance of various fissile and fertile particles under HTGR conditions. The comparative performance of several different bonding matrices was also determined. Results showed that Biso-coated ThO_2 continues to be promising as a fertile particle for the HTGR, but it does exhibit amoeba migration after a burnup exceeding 7% FIMA. Biso-coated $(4Th,U)O_2$ fissile particles containing either ^{233}U or highly enriched ^{235}U showed amoeba migration under conditions where ThO_2 showed none, indicating that the threshold conditions of burnup and temperature had been exceeded by the fissile particles, but not by the fertile particles. Both ^{235}U- and ^{233}U-bearing particles showed about the same migration rates. A comparison of rods made by extrusion and slug-injection with approximately identical fuel loadings, neutron fluxes, and surface temperatures showed that extruded rods had a significantly better fuel performance than slug-injected rods, presumably because of a higher thermal conductivity. Fissile particles made from ion exchange resins showed no amoeba migration, but moderate to severe fission product–SiC interactions were observed in the Triso coatings. Both palladium (arising primarily from plutonium fissions) and rare earths were identified in different reaction zones. Indications of a liquid phase were found where palladium reacted with SiC and in some of the kernels. 9 references. (auth)

34192 (RD/B/N-2911) HELIUM PRODUCTION IN HINKLEY "B" FUEL CANS AND TIE-BARS. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1974. 38p. (RPC/RPNK/P-(74)12; RPC/Mk2/CPSG/P-(74)1). Dep. NTIS (US Sales Only) $5.00.

The mechanisms of helium production in the structural materials of a CAGR fuel cluster is reviewed and the helium concentration calculated as a function of irradiation and fuel enrichment. The most important process is a two stage reaction starting from nickel: $^{58}Ni \xrightarrow{(n,\gamma)} {}^{59}Ni$; $^{59}Ni \xrightarrow{(n,\alpha)} {}^{56}Fe$ which has a production rate proportional to the irradiation. Other contributing mechanisms are thermal (n,α) reactions with boron-10 and fast (n,α) reactions with most elements. Because of its high nickel content the PE 16 Nimonic alloy of the tie-bar experiences a greater buildup of helium than the 20% Cr, 25% Ni Nb-stabilized stainless steel used for the fuel cans. At 20,000 MWD/Te the helium concentrations have been calculated for 5 enrichments of a Hinkley "B" cluster. (UK)

34193 TRITIUM, KRYPTON, IODINE, AND XENON PRODUCTION IN AN ADVANCED-DESIGN HTGR. Angelo, J. A. Jr.; Post, R. G.; Haskin, F. E. (Univ. of Arizona, Tucson). pp 213-230 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

An advanced-design high-temperature gas-cooled reactor has recently entered the competitive commercial nuclear power market in the United States of America. Many power projection, waste management, or atmospheric pollution studies concerned with the gaseous radionuclide effluent from irradiated fuel processing have not included the potential contribution from spent HTGR fuels. The calculated fission-product krypton, iodine, xenon, and tritium contained in the spent fuel from a 3000 MW(th) HTGR, utilizing an equilibrium Th/U fuel cycle, following a burnup of 94271 MW·d/t, show that at 100 days after discharge the HTGR spent fuel ^{85}Kr activity is nearly double that for spent LWR fuel. With an expanding HTGR role in the world nuclear power economy, the differences must be considered to determine global production rates of all fission products. (auth)

34194 UNITED KINGDOM MAGNOX STATIONS ANALYSIS OF GENERATION AVAILABILITY AT THE CEGB MAGNOX STATIONS OVER THE FIRST 10 YEARS OF THE MAGNOX PROGRAM. Gow, R. S. (Central Electricity Generating Board Headquarters, London). pp 105-122 of Experience from Operating and fuelling nuclear power plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The eight magnox stations of the Central Electricity Generating Board in the United Kingdom have been operating successfully for periods up to 10 years. Considerable operational experience has developed in many areas. Generation availability is examined and analyzed. Loss of availability has been allocated to planned outages and to forced outages. The forced outage component is divided into losses due to internal and external causes, which are separately categorized. Reactor plant forced outages are classified into 10 plant areas, these areas covering plant items which are grouped or functionally related. Non-reactor plant has been predominant in causing availability loss although a few reactor plant faults have caused isolated large losses. The mean time between outages is obtained as this is a significant figure for grid system operation. The relative duration of the outages arising from the 10 plant areas is examined, which is significant in the long-term operational planning and economics. The frequency, duration, and cause of reactor plant outages is of considerable interest to designers, and the information is presented in a readily assimilable manner. (auth)

34195 CORE MANAGEMENT, IN-CORE INSTRUMENTATION AND USE OF THE ON-LINE COMPUTER ON THE WINDSCALE ADVANCED GAS-COOLED REACTOR. Leng, J. H.; McGhee, J.; Smith, I. G. (United Kingdom Atomic Energy Authority, Windscale, Eng.). pp 589-597 of Experience from Op-

erating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The primary use of the WAGR is as a fuel-testing reactor, but in addition electrical power is generated from the heat produced. Although on-load refuelling is available, the reactor is currently refuelled on a semi-batch basis, between four and eight channels being changed at six-week intervals. Core management is aimed to satisfy three requirements; the achievement of the desired operating conditions for the experimental fuel, the production of adequate thermal output, and the optimization of fuel usage. An extremely complex core contains as many as forty fuel variants together with a number of non-fissile experiments. The effects of possible fuel loadings, chosen initially on the basis of past experience, are calculated using lattice constants from the ARGOSY code in the TRIFID two-dimensional diffusion theory burnup reactor code. Axial flux distributions are determined directly from a library of experimental measurements. Having calculated the fission rate distribution throughout the reactor, the results are used in conjunction with files of heat-transfer data, channel flow and other physical parameters to compute the ratings and temperatures expected throughout the reactor, which are then compared with experimental target values and safety limits. Examination of the results of a series of possible moves enables selection of a satisfactory loading. The same files of physical data are used for on-line computation of ratings and temperatures in the operating reactor using measured data, and are continuously updated to keep step with the physical state of the core. Experimentally determined power and temperature distributions are used to improve the forward predictions by eliminating some systematic effects. The core management and on-line computational system has been in operation about four years and has operated satisfactorily over that period. (auth)

34196 REPORT ON THE VANDELLOS NUCLEAR POWER STATION. Rierola, J. (Centro Nuclear de Vandellos, Tarragona, Spain). pp 613-628 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974). (In Spanish).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

General information on the performance of the main components of the Vandellos nuclear power station and on the results achieved during the initial phase of operation is presented. (auth)

34197 THE OPERATION OF THE EXPERIMENTAL PLANT AVR AND THE HIGH TEMPERATURE REACTOR DEVELOPMENT. Cautius, W.; Engelhard, J.; Ivens, G. (Arbeitsgemeinschaft Versuchs-Reaktor G.m.b.H., Duesseldorf (F.R. Germany)). Atomwirt., Atomtech.; 19: No. 8/9, 444-450(Aug 1974). (In German).

7 figs.; 5 tabs.; 9 refs.

The operation of the AVR high-temperature reactor in Juelich up to now demonstrated not only an excellent availability of this plant, but also surprisingly low values for the coolant gas activity and an outstandingly high inherent safety of the plant. In the future, AVR will run experiments being useful for the further development of the HTR-line. This holds true for experiments with respect to the operation of future HTR two-circuit plants as well as for one-circuit plants with helium turbine and for such reactor plants generating nuclear process heat at a high temperature level. In the AVR itself, excellent experiences were obtained at 850°C hot gas temperature; for the first time coolant gas outlet temperature of 950°C was achieved. Another important experimental field is the development and testing of HTR fuel elements. (auth)

34198 SPECIAL PROBLEMS OF INSTRUMENTATION OF HIGH TEMPERATURE GAS-COOLED REACTORS. Kaiser, G. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (F.R. Germany)). VGB Kraftwerkstechnik; 54: No. 6, 369-374(Jun 1974). (In German).

7 figs.; 18 refs.

The special requirements of instrumentation for helium cooled high temperature reactors are described, with emphasis on: temperature measurement with thermocouples and resistance thermometers, stress monitoring in the pre-stressed concrete vessel, monitoring of neutron flux, gas moisture, and position of control rods, and monitoring of pebble type fuel elements in the charging machine. Requirements of electrical bushings and cables are discussed. (auth)

34199 TEST OF THE CORE DESIGN METHODS FOR THE THTR-300 WITH EXPERIMENTAL RESULTS FROM THE CRITICAL FACILITY KAHTER. Hofmann, K.; Huebner, A.; Brandes, S. (Hochtemperatur-Reaktorbau G.m.b.H., Koeln (F.R. Germany)); Krings, F. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Reaktorentwicklung). Atomkernenergie; 23: No. 4, 238-243(1974). (In German).

10 figs.; 2 tabs.; 11 refs.

Results of experiments with a pebble bed critical facility in the Kernforschungsanlage Juelich which are done for testing design methods for High Temperature Reactors are compared with calculations. Calculational methods, computer programs and cross sections which were used in the design of the THTR-300 are tested. Particularly, measured critical masses, control rod worths and neutron flux distributions with Core 1 and Core 2 are compared with theoretical results. Modifications of power reactor design methods which were necessary for use with the critical facility are discussed. (auth)

34200 HTR FOLLOW-UP DEVELOPMENT TO DIRECT CYCLE PLANTS AND FOR THE USE OF PROCESS HEAT. Kraemer, H. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Projekt Hochtemperaturreaktor mit Heliumturbinen); Harder, H. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (F.R. Germany)); Hennies, H. (Gesellschaft fuer Hochtemperaturreaktor-Technik m.b.H., Bensberg (F.R. Germany)). Atomwirt., Atomtech.; 19: No. 8/9, 390-396(Aug 1974). (In German).

10 figs.

The gas-cooled high-temperature reactor, having gained worldwide interest during the last years, as a two-circuit plant in combination with a steam turbine, turned out to be an economical alternative to light-water reactors. Furthermore, it offers a considerable further development potential. On the one hand, with an increase of gas outlet temperature, the application of gas turbines in direct cycle is possible. On the other hand, there seems to be a broad market potential for nuclear process heat at a high temperature level. A reduction of plant cost, simplification of circuit as well as an improved behavior at partial load is expected by the application of the direct cycle. Nuclear process heat is primarily intended to be used for the conversion of mostly solid raw-materials to other energy carriers easier to transfer and to utilize, and chemical basic products, as for example methane. (auth)

34201 STATUS OF GRAPHITE DEVELOPMENT FOR HIGH TEMPERATURE REACTORS IN THE FEDERAL REPUBLIC OF GERMANY. Leushacke, D. F. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Projekt Hochtemperaturreaktor-Brennelemente). Kerntechnik; 16: No. 7, 314-322(Jul 1974). (In German, English).

5 figs.; 3 tabs.; 12 refs.

A comprehensive survey on the development of graphite for high temperature reactors, on the status of the technology and on the main points and aims of the development is given. Particular importance is given to the choice of raw material, to the reproducible fabrication of the graphite blocks, to favorable mechanical, thermal and corrosion properties and to basic irradiation tests. (GE)

34202 INSTRUMENTATION AND CONTROL. Wunderlich, R. G.; Dalry, R. H.; Burn, R. R. (General Atomic Co., San Diego, CA). Nucl. Eng. Int.; 19: No. 219, 656-658(Aug 1974).

The three major instrumentation systems at the Fulton HTGR station are described. These are the plant control system which maintains reactor power and turbine inlet steam conditions at required values, the protection systems which include the reactor trip, engineered safety features instrumentation, and trip systems for equipment protection, and the monitoring systems. (UK)

34203 MULTICAVITY PCRV. Naylan, A. J. (General Atomic Co., San Diego, CA). Nucl. Eng. Int.; 19: No. 219, 652-655(Aug 1974).

The Fulton station is the first U. S. nuclear power plant to use a multicavity prestressed concrete pressure vessel. The central cavity contains the reactor core and support structures with nine cavities located in the vessel walls, six for the main steam generator and circulation units and three for the core auxiliary cooling system heat exchanger. The basic design requirements are discussed. The prestressing system is described and details are given of the concrete and reinforcement. Details are given of the cavity liners, the penetrations for access to components, and the closures, all three of which form the continuous gas pressure boundaries of the vessel. A thermal barrier which controls the liner and concrete temperatures is also described. (UK)

34204 NUCLEAR COMPONENTS FOR HTGR. Brandt, R. E.; Cavallaro, L.; Hunt, P. S.; Wellhouser, H. N. (General Atomic Co., San Diego, CA). Nucl. Eng. Int.; 19: No. 219, 646-652(Aug 1974).

The equipment used in the cooling systems, control systems and fuel handling of the Fulton HTGR plant are described. Details are given of the steam generators, auxiliary heat exchanger, the main

helium circulator, the auxiliary circulator, the control rod mechanism and orifice assembly and the fuel handling equipment. The testing programs which have been completed and those planned for these components are outlined. (UK)

34205 CORE DESIGN CHARACTERISTICS AND FUEL CYCLE. Dahlberg, R. C.; Brooks, L. H. (General Atomic Co., San Diego, CA). Nucl. Eng. Int.; 19: No. 219, 640-646(Aug 1974).

The core design of the Fulton HTGR station is very similar to that of Fort St. Vrain and fuel performance is expected to be essentially the same. The fuel element and core configuration are illustrated and the two types of coated fuel particles which will be used are described. Details are given of the fuel cycle and comparisons are made with Peach Bottom and Fort St. Vrain. Adjustments have been made to make the fuel cycle commercially more competitive, power density being about 8 W/cc. The fuel lifetime is correspondingly shortened. The shipping casks, reprocessing facilities and the refabrication process are also described. (UK)

34206 FULTON STATION HTGR. Boyer, V. S. (Philadelphia Electric Co.); Gibbons, J. P.; Johnston, T. A.; Hoe, R. J.; Feldtmose, D. K.; Drotleff, W. C. Nucl. Eng. Int.; 19: No. 219, 635-639(Aug 1974).

The Fulton station near Lancaster, Pa., will have two 1160 MW(e) HTR's. The uranium-thorium fuel is contained in graphite moderator blocks housed in a multi-cavity prestressed concrete reactor vessel which contains the entire primary coolant system. The He coolant circulates from the core through six steam generators in each unit. Details are given of the plant layout, preparation for construction, pressure vessel, fuel, reactor core, and coolant system. The He purification system and auxiliary systems are also described. A large pull-out chart shows a cut-away drawing of the reactor and lists the main parameters. (UK)

34207 DEVELOPMENT OF HELIUM GAS TURBINE SYSTEMS IN THE NUCLEAR FIELD. Haselbacher, H.; Eiermann, A. (Brown Boveri-Sulzer Turbomachinery Ltd., Zurich). Sulzer Tech. Rev.; 56: No. 2, 68-76(1974).

The design of helium gas turbines for nuclear power stations with high-temperature gas-cooled reactors is influenced as much by the overall plant concept as by the cycle parameters and operating conditions. As examples, two helium gas turbine systems developed for reactors in the 1000 MW(e) power class with single-shaft turbomachines integrated in the prestressed concrete reactor vessels are described. One power plant is equipped with a single horizontal machine set, whereas the other one incorporates four vertical units. The same basic helium gas turbine technology is applied to the two versions. The resulting designs are discussed and the components demanding extensive development and testing are indicated. (auth)

34208 INFLUENCE OF A LOCAL OBSTRUCTION ON THE HEAT TRANSFER THROUGH A COMPACT STACKING. Joly, C. (Institut von Karman, Rhode-St. Genese, Belgium). Rev. Soc. Roy. Belge Ing. Ind.; No. 11-12, 282-297(1972). (In French).

Studies were made on the shaping of reactor cores by stacking fuel spheres. One of the principal problems to be considered is the effect of a local obstruction on the heat exchange between any sphere of a compact stack and the coolant fluid crossing this stack. This problem was treated by using an experimental method which was developed and used for each of two types of measurements: mean and local. Various obstructions were studied, and the relations obtained are presented in the generalized form $Nu = A \cdot Re^{B}$, where Nu is the Nusselt number, Re is the Reynolds number, and A and B are constants dependent on the type and importance of the obstruction. It was also established that there is an important decrease of the cooling of the spheres near the obstruction and that there are important variations of the heat exchange from one point to another of the sphere. These effects indicate that an obstruction can compromise the safety of a reactor. (tr-auth)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstracts 34128, 34273, and 34322.

34209 RESULTS OF THE RADIATION STABILITY RESEARCH OF FUEL ELEMENT PINS OF THE A-1 TYPE. Novak, J. Nukleon; No. 4, 27-30(1973). (In Czech).

The main purpose of the experiments was to determine the consequences of radiation growth and creep. A brief description of two radiation experiments and experimental results are given. 6 references. (auth)

34210 EXPERIENCE WITH CANADIAN NUCLEAR-ELECTRIC GENERATING STATIONS. Keane, E. K. (Pickering Generating Station, Ontario). pp 53-63 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants, Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The present status of the PHWR type nuclear power plants and the historic evaluation of this type of reactor, starting from the Nuclear Power Demonstration (NPD) and Douglas Point, are presented. Some of the problems experienced at the prototype stations, which have resulted in improvements at Pickering, are related to the following components or systems: (a) Fuelling machines, (b) heat transport circulating pumps and (c) heat transport chemistry. The excellent performance of the four Pickering units, which has strengthened the confidence of Ontario Hydro in the concept and the approach to building multi-unit nuclear-electric stations, is described. (auth)

34211 HIGHLIGHTS OF EXPERIENCE DURING THE COMMISSIONING AND INITIAL OPERATION OF KARACHI NUCLEAR POWER PLANT (KANUPP). Zaidi, S. M. N. (Pakistan Atomic Energy Commission, Karachi). pp 291-297 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

Karachi Nuclear Power Plant (KANUPP) is a 137- MW(e) (gross), heavy-water-moderated and cooled, natural-uranium-fuelled power plant which was placed in commercial operation in December, 1972. The plant is owned and operated by the Pakistan Atomic Energy Commission (PAEC) and has been designed, constructed and commissioned by the Canadian General Electric Company Ltd. (CGE) as prime contractors employing PAEC's station operating staff to the maximum possible extent. The commissioning and initial operation of KANUPP, like any other nuclear power plant was marked by a considerable number of technical problems including many unusual operating occurrences emanating mostly from design faults, component failures and human errors. Some of the most significant and interesting problems and occurrences encountered, together with the corrective steps taken and the lessons learned, are described. (auth)

34212 EL4 FUEL: TECHNOLOGICAL DEVELOPMENT AND EXPERIENCE OF ON-LOAD REFUELLING. Decool, F. (Centrale Nucleaire des Monts d'Arree, La Feuille, France); Gouchen, Y.; Orsier, G.; Ringot, C. pp 477-499 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The first loading of the EL4 heavy-water-moderated gas-cooled reactor consisted of fuel elements clad in stainless steel with a graphite sheath. It was important to optimize the fuel cycle, since it is a vital factor in the economics of the plant. To this end the stainless-steel-clad fuel was greatly improved, the burn-up being raised to 15,000 MWd/tU for an average enrichment of 1.70%. At the same time a new and more sophisticated fuel element with zirconium-copper cladding was developed, the final version of which is designed for a burnup of 20,000 MWd/tU at an average enrichment of 1.37%. All these improvements have been achieved progressively and their value has been confirmed experimentally without any incident in the reactor. Thanks to them, the fuel cost per kWh for this demonstration reactor compares favorably with that of large power reactors of other types. On-load refuelling and the removal of spent fuel are described. These operations are conducted in such a way as to keep the reactivity reserve and the power per channel as constant as possible while maintaining uniform rejection performance. A brief description of the equipment involved is followed by an account of the incidents that have occurred; these have been rare, however, and availability has been almost perfect. The paper concludes with some data on the cost of on-load refuelling; this is a system which permits excellent fuel utilization, the fuel being rejected with a residual ^{235}U content of less than 0.10%. (auth)

34213 PHYSICS OF CANDU ON-POWER FUELLING: FROM DESIGN OBJECTIVE TO PICKERING DEMONSTRATION. Pasanen, A. A. (Atomic Energy of Canada Ltd., Toronto). pp 501-524 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The on-power, bi-directional fuelling capability in PHWR reactors provides a large degree of flexibility in refuelling strategy. It also permits the use of relatively simple analytical methods to treat burnup depleted cores for the purpose of design studies. The so-called "homogeneous" approximation used to derive lattice parameters which characterize PHWR reactors at equilibrium fuel irradiation is described. The coarse mesh numerical models used to solve the two-group diffusion equations in three dimensions for reactor simulations are discussed. The role of on-power, bi-directional fuelling in the Pickering reactors as the primary means of maintaining the reactivity at a constant level and controlling the power distribution in the reactor is examined from the standpoint of both the design intent and actual experience. The ultimate test of the validity of employing simplified semi-empirical methods to calculate lattice parameters as a function of irradiation, together with coarse mesh numerical models to simulate the re-fuelling history of the reactor, is the degree to which they agree with experience. Operating data from the Pickering reactors is used to assess the reactor performance in respect to fuel consumption rates and the ability to maintain the power distribution close to the nominal design values by refuelling. This experience is compared with the predicted performance using these analytical methods which are the standard techniques used in core design studies. The criteria used by the operating staff in scheduling refuelling operations are described, and Pickering experience is summarized from the standpoint of the mechanics of fuel management. (auth)

34214 ELONGATION OF FUEL PINS IRRADIATED IN A GAS LOOP. Pelcik, E. (Inst. of Nuclear Research, Rez, Czech.). Nukleon; No. 2-3, 15-21(1973). (In Czech).

Irradiation experiments are described carried out in a gas loop in the VVR-S reactor and involving shape changes in fuel pins of the A-1 reactor type. The types of changes are listed and creep experiments are described in which fuel pins were irradiated and subjected to tensile stress of 10 kp and 20 kp. Investigated were the elongation of the pins, the effects of tensile stress, temperature, and thermal load. Other experiments are briefly reviewed carried out in the gas loop and involving fuel element behavior. (Nucl. Sci. Abstr. Czech)

34215 RADIOACTIVE WASTE PROCESSING IN A-1 POWER PLANT. Napravnik, J.; Diouhy, Z. (Inst. of Nuclear Research, Rez, Czech.). Nukleon; No. 2-3, 34-38(1973). (In Czech).

Test equipment for the processing of radioactive wastes is described, having a capacity of 0.1 cu m/hr and installed in the A-1 nuclear power plant. The principle of the equipment is the application of an evaporator, possible pre-treatment of liquid wastes with ion-exchangers and/or natural inorganic sorbents, and solidification of the concentrate by vacuum cementation. The evaporating unit makes it possible to process wastes irrespective of the content of non-active salts. A flow chart is given of the purification plant. (Nucl. Sci. Abstr. Czech)

34216 COMMERCIAL STEAM GENERATING HEAVY WATER REACTOR. Rippon, S. Nucl. Eng. Int.; 19: No. 219, 659-661 (Aug 1974).

The background to the development of the SGHWR is outlined. The general arrangement and parameters of the 660 MW(e) commercial SGHWR, which is the choice for the next British nuclear program, are given. Features discussed include the containment, off-load refueling, reactor plant, and control systems. Ferritic mild steel is proposed for the primary circuit pipework and the pressure tube material is Zircaloy. A novel feature is the absence of moving parts in the core: shutdown is by high speed boric acid injection, and moderator level and adjustment of boric acid content in the moderator is used for reactivity control. Also discussed are the fuel properties and the several features which contribute to the inherent safety of this system. (UK)

34217 EXPERIMENTAL STUDY OF HEAVY WATER LEVEL CONTROL SYSTEM. Hayashi, K. (Power Reactor and Nuclear Fuel Development Corp., Tokyo); Yasue, A.; Hozumi, M.; Kudo, T.; Takahashi, N. (Doryokuro Giho; No. 8, 55-61(Aug 1973). (In Japanese).

The helium system for the prototype advanced thermal reactor "Fugen" was exchanged from blower type to overflow type. In case of the overflow type, there are several unknown points, and the following items were examined, (1) correct estimation of helium gas quantity accompanying heavy water flow from overflow space, (2) property of starting ejector, (3) separation of gas from liquid in a damp tank, (4) characteristics of water level control system, and (5) development of the system to minimize released helium gas. A dynamic characteristic test of the water level control system was performed. An examination was performed for the reaffirmation of the whole system, with emphasis on the relation of the inner diameter of an overflow tube and the helium gas quantity contained in overflowing water. Through these examinations, it was confirmed that this overflow type heavy water level control system can be operated safely and stably at each stage of startup, regular operation, and shutdown. (JA)

34218 STEAM GENERATOR RELIABILITY: THE CANADIAN APPROACH. Hodge, R. I.; LeSurf, J. E.; Hilborn, J. W. (Chalk River Nuclear Labs., Ont.). Energ. Nucl. (Milan); 21: No. 8-9, 465-484(1974).

From 19th nuclear congress; Rome, Italy (21 Mar 1974).

The Canadian operating experience obtained with steam generators in PHWR type power reactors is outlined. The program on vibrations and fretting, which consists of experiments on hydraulic excitation and of fretting measurements, which is providing a more rational basis for design, is explained together with the corrosion program, which is mainly concerned with evaluation of tube materials and specification of water chemistry to avoid pitting and cracking from the secondary side. Procedures are described which have been developed to locate leaking tubes and to carry out rapid field repair by explosive plugging. (auth)

Power Reactors, Breeding

Refer also to abstracts 31906, 32977, 34128, 34183, 34256, 34258, 34265, 34286, and 34302.

34219 (ANL-8068) NUBOW: A FORTRAN-IV PROGRAM FOR THE STATIC ELASTIC STRUCTURAL ANALYSIS OF BOWED REACTOR CORES. McLennan, G. A. (Argonne National Lab., Ill. (USA)). Apr 1974. Contract W-31-109-eng-38. 91p. AT.

A description is given of the FORTRAN-IV computer program NUBOW, for the two-dimensional elastic analysis of LMFBR core systems subjected to thermal or mechanical bowing. The program calculates the mechanical equilibrium configuration of the core treating the ducts as elastic beam members. Clearance and local flexibility are allowed at each contact. Included in the output from the program are the support and contact forces, the final deflected shapes of the beams, and the structural reactivity change resulting from the radial fuel displacement. NUBOW was developed to fulfill two objectives: (1) to extend the capability of existing codes to include more variable geometry, more contact and support points, and clearances at all contacts; and (2) to serve as a tool and building model for the development of a three-dimensional core analysis program. A detailed description of the analytical model and input quantities as well as descriptions and listings of the main program and subroutine are included to serve as a user's manual for those using the program for analysis and design, and as a program manual for those interested in modifying it for other related uses. NUBOW is fully operational on the IBM 360/195 and should be easily adaptable to run on other computers. (auth)

34220 (ANL-8089) TRITIUM TRANSPORT IN AN LMFBR. Kumar, R. (Argonne National Lab., Ill. (USA)). Aug 1974. Contract W-31-109-Eng-38. 38p. AT.

A computer model has been developed to simulate the transportation and distribution of tritium in a liquid-metal-cooled fast breeder reactor (LMFBR). The model has been successfully used to correlate tritium data obtained in the Experimental Breeder Reactor-II (EBR-II). Projected tritium distributions in the Fast Flux Test Facility (FFTF) have been calculated for a range of values of the major model parameters. It is estimated that under normal operation FFTF will release 3 to 6 Ci of tritium to the environment per day of full power (400 MWt) operation, compared with the normal release from EBR-II of about 4 mCi/day while operating at 62.5 MW(t). 15 references. (auth)

34221 (CEA-CONF-2641) TOWARDS COMMERCIAL FAST REACTORS: THE FIRST 1200 MWe UNIT. Banal, M.; Carle, R. (Electricite de France, 75-Paris; CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Div. de Construction des Reacteurs). 1973. 12p. (In French). Dep. NTIS (US Sales Only) $4.00.

It is shown that although the technical options are common to Rapsodie and its successors, there have been substantial changes in the conditions in which successive projects were executed. The 1200 MW(e) unit comes as closely as possible to true industrial-style methods. RAPSODIE was a starting point, and PHENIX was the first model of an industrial scale unit. RAPSODIE remains a valuable tool that can be used to carry out endurance testing of sodium technology at the same time as irradiation studies are made in a fine approximation to actual working conditions of mixed plutonium and uranium oxide fuel. (FR)

34222 (CONF-740903-4) CONSTRAINED NUCLEAR DESIGN. Barthold, W. P. (Argonne National Lab., Ill. (USA)). 1974. 9p. Dep. NTIS $4.00.

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974).

By imposing constraints on the design of a reactor it is possible to reduce the number of iterations between mechanical, thermal and nuclear design. The constraints discussed are geometry constraints, physics constraints, pressure drop constraint, sodium velocity constraint and burnup and fluence limit constraints. In addition to reducing the number of design iterations, this approach helps to identify key design parameters as well as key design constraints. (auth)

34223 (CONF-740903-6) FAST REACTOR CROSS-SECTION PROCESSING CODES: IS THERE A DOLLARS WORTH OF DIFFERENCE BETWEEN THEM? Weisbin, C. R.; Greene, N. M.; Henryson, H. II; LaBauver, R. J.; Durston, C.; Cullen, D. E.; Kidman, R. B. (Oak Ridge National Lab., Tenn. (USA); Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.; Argonne National Lab., Ill. (USA); Los Alamos Scientific Lab., N. Mex. (USA); California Univ., Livermore (USA). Lawrence Livermore Lab.). 1974. 29p. Dep. NTIS $4.50.

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974).

Various ENDF/B cross section processing codes for fast reactor calculations are considered from the standpoints of accuracy and cost in obtaining a given accuracy. The range of applicability and effort required in the use of several multigroup averaging programs currently in wide use are discussed. A brief summary is given of the status and current capabilities of the programs, and sample multigroup constants obtained with the programs are tabulated to illustrate the magnitude of the differences obtained for individual cross sections and transfer matrix elements. (DG)

34224 (CONF-740903-9) ANALYSIS OF STORED FUEL, CONTROL ROD AND INHERENT SOURCE EFFECTS ON THE CRBR EX-VESSEL SOURCE RANGE MONITORING SYSTEM. Flanagan, G. F.; Engle, W. W. Jr.; Williams, L. R.; Mynatt, F. R. (Oak Ridge National Lab., Tenn. (USA)). 1974. 6p. Dep. NTIS $4.00.

From meeting on advanced reactors; physics, design and economics; Atlanta, Georgia, USA (8 Sep 1974).

In order to determine the feasibility of an ex-vessel low-level flux monitor for use in the Clinch River Breeder Reactor, several possible problem areas needed to be analyzed. Among these were the effect of stored fuel on the detector, and the effect of control rod movements and source changes during refueling. The techniques used and the results of such an analysis are described. 7 references. (auth)

34225 (CONF-741017-15) DUCT-WALL TEMPERATURES DUE TO A HEATED-ZONE EDGE BLOCKAGE IN A SODIUM-COOLED 19-ROD BUNDLE. Wantland, J. L.; Fontana, M. H.; Gnadt, P. A.; Kress, T. S.; MacPherson, R. E.; Parsly, L. F. (Oak Ridge National Lab., Tenn. (USA)). 1974. 4p. Dep. NTIS $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

Temperature distributions have been measured in a 19-rod bundle with a heated-zone edge blockage in the ORNL LMFBR Fuel Failure Mockup, an engineering-scale sodium thermal-hydraulic facility. The fuel rods were simulated by electrical heaters of the same configuration as the FFTF and CRBR (0.230-in. OD, 0.056-in.-dia wire-wrap spacers on a 12-in. pitch) except for the heated length. The heated length of this bundle was 18-in. and the edge gaps were reduced to half size by using 0.028-in.-dia wire wraps on the peripheral rods. Where normal spacing for interior gaps was required these wires were sleeved by stainless-steel tubes. The bundle had four types of temperature instrumentation: thermocouples on the inner surface of the heater sheaths, thermocouples in the wire-wrap spacers, thermocouples in the hexagonal duct wall, and an exit thermocouple rake. Only the results from the duct-wall thermocouples are presented. The blockage consisted of a $\frac{1}{8}$-in.-thick stainless-steel plate located 4-in. downstream from the start of the heated section. (auth)

34226 (CONF-741017-17) THERMAL EFFECTS OF HALF-SIZE EDGE GAPS IN SODIUM-COOLED 19-ROD BUNDLES. Wantland, J. L.; Fontana, M. H.; Gnadt, P. A.; Kress, T. S.; MacPherson, R. E.; Parsly, L. F. (Oak Ridge National Lab., Tenn. (USA)). 1974. 4p. Dep. NTIS $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

Results of thermal-hydraulic testing of 19-rod bundles conducted in the ORNL LMFBR Fuel Failure Mockup are reported. The fuel rods were simulated by electrical heaters of the same configuration as the FFTF and CRBR. The tests were conducted with all rods heated uniformly at 5 kW/ft-rod and analogous sodium flows giving similar velocities. The results are expressed as dimensionless sodium temperature rises, $(T - T_{in})/(T_{out} - T_{in})$. It was concluded that the use of half-size edge gaps is quite effective in flattening the radial temperature profiles in uniformly-heated 19-rod bundles. (DG)

34227 (COO-2245-9-TR) INSTRUMENTATION METHODS FOR INTERCHANNEL COOLANT MIXING STUDIES IN WIRE-WRAP SPACED NUCLEAR FUEL ASSEMBLIES. Eaton, T. E.; Todreas, N. E. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Jun 1974. Contract AT(11-1)-2245. 558p. Dep. NTIS $31.00.

A wire-wrap spaced, rhombus shaped, 25-pin experimental rod array was constructed with parameters typical of LMFBR's: D = 0.25 in., P/D = 1.25, Lead = 12 in. Instrumentation design for coolant mixing experiments is discussed in detail. Salt (NaCl) solution tracers were used. Experiments revealed no influence of salt type or injection solution concentration on results. Transverse injection caused more flow perturbation than a hypodermic tube mounted at 20° from the tube centerline. Injection velocity influenced the flow perturbations. Injection at the average subchannel velocity was used with water for the flow media. Using an injector moving over the upper thirty inches of the rod array, tracer dispersion was detected at the outlet. The instrumentation was evaluated by comparing the tracer injected to that detected. Inherent loss of tracer due to concentration inhomogeneities occurred over the last four inches of injector-detector separation with no serious effects. An unexpected loss of mass occurred at separations greater than twelve inches due to mechanical difficulties in the design. The axial behavior of interchannel coolant mixing with tracer injection into an interior and a peripheral subchannel was established for both turbulent and laminar flow and required more than four data points per inch for its complete determination. With interior subchannel injection, the tracer dispersion pattern was dominated by flow sweeping effects with separations less than twelve inches; at greater separations, natural turbulent interchange dominated the dispersion. In laminar flow, the results were similar; however, the amount of tracer transferred by flow sweeping was markedly increased, apparently due to the change in wire-wrap drag coefficient and the absence of turbulence. The laminar flow signal fluctuated due to wire-wrap vortex shedding or injection instabilities. Peripheral injection mixing results were similar except the results were dominated by flow sweeping over the entire injector travel. A swirl flow around the bundle periphery was determined to be 4.9° ± 1.4° using salt tracer data and 5.5° ± 1.0° via flow visualization. The swirl flow remained separated from the rod gaps and did not mix with adjacent interior subchannels in either flow regime. (auth)

34228 (COO-2245-10) COOLANT MIXING IN LMFBR ROD BUNDLES. Quarterly Progress Report, March 1, 1974 – May 31, 1974. Todreas, N. E. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). 1974. Contract AT(11-1)-2245. 23p. Dep. NTIS $4.00.

Progress is reported on the development of analytical models and measuring equipment and methods for studying coolant mixing in LMFBR channels and in assessing available hydraulic test data on such mixing. (DG)

34229 (COO-2426-7) SAFETY MARGINS FOR SODIUM BONDED CARBIDE FUEL. Siegmann, E. R.; Gilbertson, J. C. (Combustion Engineering, Inc., Windsor, Conn. (USA)). 1974. 4p. (CONF-741017-12). Dep. NTIS $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

Unvented sodium bonded fuel has the potential for sudden bond loss and, consequently, sudden fuel temperature increase. This is a potential new mechanism for local fuel failure propagation. The high thermal conductivity of carbide compared to oxide has lead to speculation that vapor explosions may be more probable with carbide and that higher energy yields might be obtained from molten fuel/coolant interactions. The sodium bond behavior and the effects of fuel coolant interactions (FCI) in carbide fuel assemblies are analyzed. 3 references. (auth)

34230 (COO-2426-8) OPTIMUM PIN DIAMETER FOR LMFBR ADVANCED FUELS. Doherty, P. K.; Caspersson, S. A.; Hanus, N.; Noyes, R. C.; Stuteville, D. W. (Combustion Engineering, Inc., Windsor, Conn. (USA)). 1974. 6p. (CONF-741017-5). Dep. NTIS $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

Of the several design parameters that affect doubling time, fuel pin diameter is the most important. Another important parameter is the tightness of the pin packing or fuel pin pitch to diameter

ratio (P/D). A small pin diameter gives a low fissile inventory which reduces the doubling time. On the other hand, large pin diameters lead to large fuel volume fractions which maximize the breeding ratio and thereby lower the doubling time. The pin diameter which yields the lowest doubling time is that which achieves the best balance between breeding and inventory. Tight pin packing also tends to maximize the fuel volume fraction, thus maximizing breeding ratio and minimizing doubling time. However, tight pin packing increases coolant velocity and pressure drop and thus increases the amount of steel in the core. Tightly packed cores with a range of fuel pin diameters are therefore investigated. The study is primarily concerned with determining whether there is an incentive for developing high velocity, low P/D designs utilizing relatively small diameter fuel pins. 5 references. (auth)

34231 (EIR-261) OPTIMUM DESIGN OF GAS COOLED FAST REACTOR CORES. Kypreos, S.; Haschke, D. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Aug 1974. 34p. Dep. NTIS (US Sales Only) $4.75.

Optimum design of gas cooled fast reactor cores for nuclear power plants in the range of 1000 to 2000 MW(e) is discussed. It is shown how an optimization of the total power generation cost for different economic assumptions leads to optimum core designs. The main parameters influencing the selection of a particular core design are the fuel fabrication cost and the price of fissile plutonium. On the basis of the experience gained through the optimization study of 1000 MW(e) plants, an extrapolation of core power was made up to a size for a 2000 MW(e) plant. Emphasis in this extrapolation study was on core nuclear characteristics and fuel cycle costs. Total power costs have not been optimized because of the large uncertainties in plant capital cost estimates. It was found that an increase in core power is feasible, at least from a neutron physics point of view and optimization indicated a savings in the fuel cycle costs. (auth)

34232 (EURFNR-1155) DESIGN, IRRADIATION AND POST-IRRADIATION EXAMINATION OF THE UO_2/PuO_2 FUEL PIN SPECIMENS IN TEST DFR-304. Kummerer, K.; Geithoff, D. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Material- und Festkoerperforschung). Jan 1974. Translation of KFK-1814. 87p. Dep. NTIS $7.50.

Work performed under United States–Euratom Fast Reactor Exchange Program.

The irradiation of 3 fuel pins with UO_2-PuO_2 fuel and a stainless steel cladding in the fast flux of the NaK cooled Dounreay Fast Reactor is reported. The design of the pins with respect of composition and geometry as well as of operational conditions was representative for a prototype fast reactor like SNR-300. Included are all data and facts concerning the experimental objectives, the pin design and specifications, the fabrication of the pins and the preirradiation tests, the irradiation history and the nondestructive and destructive post-irradiation examination. (auth)

34233 (EURFNR-1157) TEMPERATURE DISTRIBUTION IN A FUEL PIN STRESSED BY DIFFERENT TYPES OF HEAT SOURCES. Keller, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Jan 1974. Translation of KFK-1916. 24p. Dep. NTIS $4.25.

Work performed under United States–Euratom Fast Reactor Exchange Program.

From the general heat conduction equation, solutions are developed that describe various possible operational conditions of a nuclear fuel pin. These solutions are analytically transformed to a state permitting ready and organizationally lucid digital programming. (auth)

34234 (EURFNR-1161) EXPERIMENTAL INVESTIGATIONS ON COOLANT CROSS MIXING AND PRESSURE DROP IN ROD BUNDLES WITH HELICAL SPACERS. Influence of the Results on the Design of Fuel Elements for Sodium-Cooled Fast Reactors. Hofmann, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorbauelemente). Dec 1973. Translation of KFK-1843. 165p. Dep. NTIS $5.45.

Work performed under United States–Euratom Fast Reactor Exchange Program.

LMFBR fuel assemblies consisting of triangular arranged rods within a hexagonal shroud were studied. Helical type spacers (helical wires, helical fins) were used to support the rods. The thermo- and fluiddynamic behavior of the multirod-clusters were investigated for characteristic spacer arrangements mainly differing from each other by the spacer type, the helical spacer lead, and the number of spacers per rod. An optimal bundle geometry was selected, which was characterized by the fact that for a given maximum allowable canning temperature the mean coolant outlet temperature of the bundle should be as high as possible and the axial pressure drop as low as possible. The thermo- and fluiddynamic calculations were carried out with the MISTRAL-II code. Characteristic values for coolant cross-mixing and pressure drop were determined experimentally on the rod and spacer arrangements provided. For the experiments, 61-rod clusters were used with the specific dimensions of the fuel element of the sodium cooled fast breeder reactor SNR-300. Coolant cross-mixing was investigated in a sodium flow within the range of Reynolds numbers from 8×10^3 to 7×10^4, using the "heating method". The pressure drop experiments were carried out in an air flow at Reynolds numbers from 1×10^4 to 1.7×10^5. To support the use of the computer program for bundle design, additional experiments were carried out with several rods heated simultaneously. The comparisons of the calculational results show that within the rod and spacer configurations under consideration rods with 3 integral helical fins as spacers are a very useful solution in realizing multirod-clusters with optimum thermo- und fluiddynamic characteristics. (auth)

34235 (KFK-1274/1) 1. QUARTERLY REPORT 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Jun 1974. vp. (In German). (EUR-4976-d). INIS.

With figs., tabs. and refs. With abstract in German and English.

An account of investigations performed by institutes of the GfK in Karlsruhe or under contract on behalf of the GfK is given. The subjects of the report are: fuel pin development, materials testing and development, corrosion tests and coolant analysis, fuel cycle studies, safety and instrumentation, as well as technological investigations. (GE)

34236 (KFK-1997) THESYS–A FORTRAN-PROGRAM FOR CALCULATING THE THREE-DIMENSIONAL NOMINAL TEMPERATURE DISTRIBUTION IN FAST REACTOR CORES. Doetschmann, K. (Kernforschungszentrum Karlsruhe (F. R. Germany) Inst. fuer Reaktorentwicklung; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Jul 1974. 50p. (In German). INIS.

17 figs.; 22 refs. With abstract in German and English.

A method is described to calculate the three-dimensional nominal temperature distribution in a fast reactor core. Nominal means an undisturbed core geometry and steady state conditions. This nominal temperature distribution is the basis for such design calculations as hot spot analysis, core deformation and the determination of thermal reactivity coefficients. The calculation is based on a subchannel analysis for each subassembly of the core. Such models are commonly used in calculating the temperature distribution is fluids flowing in-line in pin bundle geometry. The original part of this work lies in the adaption of the above method to the whole core (or to a representative section of the core) and the solution of the numerical problems associated with this procedure. Further, the calculation of the temperature distribution in the subassembly wrapper (which determines the core bowing) is included in the model. Therefore the heat exchange processes between neighboring subassemblies in the core are considered as well as the heat exchange processes in the subassembly itself. The influence on the temperature distribution is analyzed and it is shown that both processes have to be considered. The problem of calculating the magnitude of the heat transfer between subchannels is discussed in detail and it is shown by parametric calculations that the present uncertainties are, in general, tolerable for the task under discussion. (auth)

34237 (KFK-2003) STATUS REPORT 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Mar 1974. 187p. (In German). INIS.

14 refs.; 11 figs.; with tabs. With abstract in German and English.

The papers read at the Status Report of the Fast Breeder Project at the Karlsruhe Nuclear Research Center on March 26, 1974 are presented. The first papers present a general survey of the present state of research and development work performed by the German, Belgian, and Netherlands research centers on the SNR 300 Prototype Fast Breeder Reactor (Kalkar Nuclear Power Station), on the SNR follow-on program, alternative fuels and coolants and basic problems, on work performed by industry with respect to the licensing procedure and construction of the SNR 300, and on commissioning and the planned conversion of KNK, the Compact Sodium Cooled Nuclear Reactor. The detailed papers deal with results elaborated at the institutes of GfK Karlsruhe, SCK/CEN Mol, RCN Petten, and TNO Apeldoorn. Most of these efforts have been concentrated upon fuel pin and materials development and on the physics and safety of fast reactors. The status report concludes with a reference to the future program under the Project. (auth)

34238 (KFK-2012) PHYSICS INVESTIGATIONS OF SODIUM COOLED FAST REACTORS SNEAK-ASSEMBLY 9B. P. 1. Jourdan, G. (Kernforschungszentrum Karlsruhe (F. R. Germany).

Inst. fuer Angewandte Systemtechnik und Reaktorphysik; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). Jul 1974. 55p. INIS.

14 figs.; 10 tabs.; 17 refs. With abstract in German and English.

SNEAK-Assembly 9 was aimed at measuring physics parameters of a fast sodium cooled breeder having a number of features typical of the prototype SNR. As a consequence of the different aims it was necessary to build the assembly SNEAK-9 in three modifications: SNEAK-9, SNEAK-9B and SNEAK-9C. SNEAK-9B has three zones, an inner Pu-zone, an uranium zone and the blanket zone. The cell of the Pu-zone was very simple to facilitate the evaluation of the experiments. Important measurements in this zone were: sodium void measurements of large zones, absorber worth and reaction rate measurements. The experimental results were compared to detailed calculations. All experiments performed in SNEAK-9B are described, except for the reaction rate measurements. (auth)

34239 (KFK-2018) INVESTIGATIONS ON SHUT-DOWN RODS LOADED WITH A COMBINATION OF AN ABSORBER AND A MODERATOR FOR FAST REACTORS. Heinzel, V. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik; Karlsruhe Univ. (TH) (F. R. Germany). Fakultaet fuer Maschinenbau). Jul 1974. vp. (In German). INIS.

35 figs.; 8 tabs.; 29 refs. With abstract in German and English.

The reactivity worth of scram rods assembled with a moderator and an absorber is theoretically and experimentally investigated. The theoretical investigations use as varying parameters the volume ratio of the moderator and absorber, rod construction and size, type and density of moderator and absorber, and the boron enrichment. The experiments were used to confirm the theoretical results, and to investigate rod bundle geometries frequently used in power reactors. The results show two interesting operational aspects: (1) Assuming a scram rod consisting only of non-enriched absorber material, the insertion of a moderator causes an increase in reactivity worth. If a higher reactivity worth is demanded, one need not increase the enrichment of the absorber, instead one can add a moderating material. (2) Assuming a scram rod consisting of a highly enriched absorber like B_4C with 90% enriched boron-10, no more increase of reactivity worth can be obtained by the addition of moderating materials. However, it is possible to partially replace the highly enriched absorber by adding a moderator without loss of reactivity worth. (auth)

34240 (ORNL-TM-4222) SDT 11. ORNL BENCHMARK EXPERIMENT FOR NEUTRON TRANSPORT THROUGH IRON AND STAINLESS STEEL. Part I. Maerker, R. E. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 56p. (ENDF-188). Dep. NTIS $6.00.

The first part of an experiment concerning deep neutron penetration in iron and stainless steel is described, and experimental results in a format for shielding integral data testing are presented. These results provide a basis for verification of the accuracy of iron and stainless steel cross sections used in transport calculations. The experiment was performed at the Tower Shielding Facility of ORNL and included measurements of both the neutron fluence and neutron spectra behind slabs of iron up to 3 ft thick and of stainless steel up to 1 ft thick. (auth)

34241 (RT/FI-(74)29) NASTAP: A PROGRAM FOR THE CALCULATION OF THE STATIONARY DISTRIBUTION OF POWER, TEMPERATURE, AND MASS FLOW IN A FAST SODIUM-COOLED REACTOR. Buffoni, G.; Galati, A.; Musco, A. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). May 1974. 32p. (In Italian). Dep. NTIS (U. S. Sales Only) $4.75.

The two-dimensional code NASTAP calculates stationary distribution of power, temperature and mass flow-rate in a sodium cooled fast reactor. Input/output specifications of the NASTAP code are given. (6 references) (auth)

34242 (SAND-74-5203) THERMAL STRESS IN CLADDING DURING SIMULATED LMFBR OVERPOWER TRANSIENTS. Croucher, D. W.; Schmidt, T. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 12p. (CONF-741017-3). Dep. NTIS $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

Stainless steel clad uranium dioxide fuel pellets were pulse irradiated in the Annular Core Pulse Reactor to evaluate thermal stress as a contributing mechanism for cladding failure in hypothetical LMFBR overpower transients. The fuel pellets, 0.24 inch in diameter with enrichments up to 25 wt % ^{235}U, were helium bonded to 15 mil thick Type-316 stainless steel cladding and were irradiated in a helium environment with reactor pulses having initial periods as short as 1.5 milliseconds. In experiments conducted elsewhere with longer initial periods, the primary fuel failure mechanisms observed were differential fuel-cladding thermal expansion, intergranular fission gas-induced fuel swelling, transient fission gas release, and cladding melt through. Analysis indicates that these mechanisms are somewhat insensitive to the heating rate and that the molten fuel volume fraction is the failure determining parameter. Thermal stresses, however, exhibit a strong dependence on heating rate and become non-negligible for severe excursions. 8 references. (auth)

34243 (WAPD-TM-1141) SPATIAL DISTRIBUTION OF THE INDIUM ACTIVATION IN A WATER MODERATED THORIUM OXIDE ROD LATTICE USING A ^{252}Cf SOURCE (LWBR DEVELOPMENT PROGRAM). (Bettis Atomic Power Lab., Pittsburgh, Pa. (USA)). Sep 1974. Contract AT(36-1)-GEN-14. 26p. Dep. NTIS $4.50.

A large water moderated lattice of Zircaloy-4 rods filled with thoria pellets was used to test the cross sections of thorium, Zircaloy-4, hydrogen, and oxygen, and to measure the neutron age using the indium activation technique. A 5-milligram ^{252}Cf source was located in the central rod position of the lattice, and cadmium-covered indium foils were used inside the rods to measure the radial distribution of the 1.46 eV neutron flux from approximately 4.5 to 70.0 centimeters from the source. The measured distribution compared with a higher approximation of a one-dimensional P3 calculation. The measured age of 61.4 ± 1.4 cm^2 obtained by numerical integration of the experimental data is in good agreement with the calculational age of 60.1 cm^2. (auth)

34244 (WAPD-TM-1183) DECAY HEATING MEASUREMENTS AND CALCULATIONS FOR IRRADIATED ^{235}U, ^{233}U, ^{239}Pu, AND ^{232}Th. (LWBR Development Program). Gunst, S. B.; Conway, D. E.; Connor, J. C. (Bettis Atomic Power Lab., Pittsburgh, Pa. (USA)). Jul 1974. Contract AT(36-1)-GEN-14. 75p. Dep. NTIS $6.75.

Samples of ^{235}U, ^{233}U, ^{239}Pu and ^{232}Th have been irradiated in high neutron fluxes ($>10^{14}$ n/cm^2-sec) and their decay heatings have been measured as functions of cooling time from 14 hours to 4500 hours after removal from the high flux. To measure the rate of heat emission, an underwater calorimeter has been developed. For the measured exposure histories, decay heatings have also been calculated for the concentrations of 190 fission products, all significant heavy isotopes, and structural nuclides. Account is taken of the energy carried by gamma rays that escape the calorimeter. Measurements and calculations of the decay heating captured within the calorimeter agree within two standard deviations for all samples and cooling times and, in general, agree within 2%. For the ^{235}U sample, calculations based on the Proposed ANS Standard ANS-5.1 agree with the measurements within a few percent. 17 references. (auth)

34245 (WARD-OX-3045-14) OXIDE FUEL ELEMENT DEVELOPMENT. Quarterly Progress Report for Period Ending June 30, 1974. Boltax, A.; Saling, J. H. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Sep 1974. Contract AT(11-1)-3045. 90p. AT.

Progress in the development and testing of stainless steel clad mixed oxide fuel pins for LMFBR's is reported. Included are discussions and data on fuel pin irradiation testing in EBR-2, LMFBR grid-type subassembly design and evaluation, and analytical methods for evaluation of fuel and cladding irradiation behavior. (DCC)

34246 INVESTIGATION OF STABILITY AND EQUALIZATION OF HEAT-RELEASE FIELD IN FAST REACTORS. Usynin, G. B.; Chirkov, V. K. At. Energ. (USSR); 37: No. 2, 123-126(Aug 1974). (In Russian).

A method of determining optimal equalization of heat-release field taking into account its behavior during the operating period is proposed. There are presented linear approximate dependences of coefficients of irregularity and coolant dilution in a fast power reactor on eleven factors, and the representation of these coefficients in the form of polynomials of the second order relative to core flattening, radius of low-enrichment core, enrichment and burnup ratios. The method of choosing initial enrichments in the core is described. 6 references. (auth)

34247 GAS FAST AND THERMAL BREEDER REACTORS. Feinberg, S. M. At. Energ. (USSR); 37: No. 1, 3-10(Jul 1974). (In Russian).

An analysis is presented of possible means of developing breeder reactors other than the prevalent liquid-metal coolant breeders. Gas and thermal fast uranium–thorium systems are considered. The basic physical characteristics of the systems are analyzed and differences in technical and engineering solutions in creating such reactors discussed. 5 references. (auth)

34248 NEW POSSIBILITIES OF CREATING GAS-COOLED FAST REACTORS WITH SHORT-PERIOD DOUBLING OF FUEL.

Krasin, A. K.; Nesterenko, V. B. At. Energ. (USSR); 37: No. 1, 11-21(Jul 1974). (In Russian).

A complex of theoretical and experimental investigations and design studies for atomic power stations of large power (1000 MW electricity) has made it possible at present to go over to the design and construction of an experimental-industrial atomic power station based on gas-cooled reactors using dissociating N_2O_4 coolant. The purpose of this station is to work out the basic technology and construction of a high-flux gas-cooled fast reactor using dissociating N_2O_4 coolant and to determine the conditions providing maximal possible production of nuclear fuel for minimal possible period of fuel doubling. The main overall characteristics of the experimental-industrial atomic power station are presented. 20 references. (auth)

34249 PROBLEMS WITH SODIUM STEAM GENERATORS: EXAMPLE OF A LEAKAGE IN A STEAM GENERATOR OF THE SODIUM-COOLED KNK NUCLEAR POWER STATION. Marth, W.; Dumm, K. (Gesellschaft fuer Kernforschung mbH-Versuchsanlagen, Leopoldshafen, Ger.). pp 343-352 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/Pub-351; CONF-731083-.

Sodium-cooled fast breeder power stations still include numerous problems whose solution is the object of active efforts taken in all big industrial nations. Sodium-heated steam generators are particularly critical components. They run sodium, water, and steam in lines closely adjacent to each other. Hence, in the event of leaks, for instance in welds, violent reactions may be generated. In the commissioning phase of KNK, a sodium-cooled nuclear power station of 60 MW(th), in late 1972, a leak was detected in the steam generator. The relatively modest causes are contrasted with the severe results in order to emphasize the tremendous influence such incidents can have on the availability of power stations. The cause of the damage was a badly made weld in the sodium-carrying steam generator tube, which resulted in a hole of about 1 mm^2. This caused a reaction between some 65 kg of hot sodium from the secondary system and water and steam of the tertiary system. The resultant irregularities in the nuclear power plant were discovered in time by the operating crew and the plant was shut down manually only two minutes later. The results of this incident can be summarized as follows: The plant was shut down for three months, during which time the nuclear operating license was suspended. The products of the sodium-water reaction had completely polluted the secondary system and even progressed as far as a point upstream of the turbine in the tertiary system. In addition, sodium oxide, which is practically insoluble, clogged the three steam generator tubes. These tubes could not be cleared again and had to be cut off. For future similar incidents to be brought under control, major changes in the circuit design would be required. From similar leaks in other nuclear power stations and experimental facilities, it is apparent that considerable development work is still required for sodium steam generators. One of the most urgent problems appears to be to control leaks such that no excessive interruptions of plant operation result. Studies have so far concentrated on problems of changes in pressure and volume as large quantities of sodium flow into water. These studies have already produced a variety of results and could now be assigned lower priority. (auth)

34250 STATUS AND TREND OF THE FAST BREEDER DEVELOPMENT IN 1974. Engelmann, P. (Kernforschungszentrum Karlsruhe (F.R. Germany). Projekt Schneller Brueter); Mausbeck, H. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F.R. Germany)). Atomwirt., Atomtech.; 19: No. 8/9, 397-404(Aug 1974). (In German).

From reactor meeting; Berlin, F.R. Germany (2 Apr 1974). 9 figs.; 1 tab.; 21 refs.

The fast breeder development entered a new phase with the start of operation of the prototype reactors Phenix, PFR, BN-350 and with the erection of the SNR-300. The sodium technology turned out to be successful and the nuclear part entered a period of operational experience. Experiences in erection and commissioning of the first prototypes brought about encouraging results. Problems expected to occur during initial operation could be solved soon in most cases. Now the development status of main components and corresponding material problems are of special interest. Comparing the prototype PFR, Phenix and SNR-300 the development status of steam generators, intermediate heat exchangers, pumps, lid-systems, core components and structural materials is thoroughly treated. Besides, questions of sodium purity and the development of safety instrumentation are considered. An outlook is given on the next phase of the fast breeder development and, as an alternative concept, the gas-cooled breeder. (auth)

34251 PLANNING FOR THE SECOND LMFBR DEMONSTRATION PLANT: A 1000-Mw COMMERCIAL PROTOTYPE. Noyes, R. C.; Vitti, J. A.; Penfield, S. R. Combustion; 46: No. 3, 5-11(Sep 1974).

From American Power Conference; Chicago, IL (29 Apr 1974).

Design studies for the second demonstration plant are described. Included are specifications for plant components and a description of the overall plant. Safety and reliability receive primary emphasis, followed by considerations of commercial viability of the LMFBR concept. (DG)

34252 LECTURES ON FAST REACTORS. Wirtz, K. Karlsruhe, F.R. Germany; GfK (1973). 307p.

With figs.; tabs. and refs. Available from the Literaturabteilung of the GfK.

The lectures presented deal with the physical, technical, safety, and material problems of fast reactors. Economical questions will not be discussed, although they ultimately will be decisive for the chances of fast power reactors on the energy market. (auth)

34253 SYSTEM APPROACH IN ECONOMIC ASSESSMENTS OF NUCLEAR POWER. Illiffe, C. E. (United Kingdom Atomic Energy Authority, Risley, Eng.). pp 33-43 of Energy Modelling. Guildford, Eng.; IPC Science and Technology Press, Ltd. (1973).

From special workshop on energy modelling; London, England (15 Oct 1973).

Economic assessment of nuclear stations as part of a complete generating system has many advantages. One of these is independence of plutonium price, although the value of plutonium to the system is readily found. The method is most realistically applied by means of a digital computer model. This may merely simulate the system or attempt to optimize it by means of linear programming. As applied to a fast reactor strategy, the results can be expressed in terms of a "system" cost analogous to the generating cost of a single station and can be used to assess, for instance, the effect of interchanging merit order as between the fast reactor and its supporting thermal reactor. The approach requires the discount rate to exceed the ultimate growth rate of the system, a requirement which is likely to be met. (auth)

34254 NUCLEAR ENERGY. II. From Fission to Fusion. Leslie, D. C. (Queen Mary Coll., London). pp 123-134 of Energy: From Surplus to Scarcity. Inglis, K. A. D. (ed.). Barking, Eng.; Applied Science Publishers Ltd. (1974).

From conference on energy: from surplus to scarcity; Harrogate, England (5 Jun 1973).

The design philosophy of fast reactors is discussed and a brief description is given of the sodium cooled fast reactor. The fundamentals of fusion are stated, and the prospects for fusion reactors operating either by magnetic confinement of the plasma or by ablative compression are considered. (UK)

Research, Test, and Experimental Reactors

Refer also to abstracts 32318, 34128, 34132, 34133, 34225, 34236, 34310, and 34393.

34255 (ANCR-1169) DECAY HEATING IN THE ETR CORE WITH THE FEFPL LOOP, AND IN THE ETR CANAL STORAGE. McMurry, H. L.; Jones, R. R. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Aug 1974. Contract AT(10-1)-1375. 79p. Dep. NTIS $5.45.

A detailed description of the computer oriented methods used at Aerojet Nuclear Company to calculate decay heating is given. This can be used as a guide for future calculations of decay heating. The methods are applied to calculate the decay heating in the ETR core at various times after shutdown following 56.7 days operation at 175 MW. The methods are sufficiently versatile to provide for estimating the distribution of heat generation within fuel elements, and in adjacent regions. 10 references. (auth)

34256 (CEA-N-1673) ANALYSIS OF CENTRAL REACTIVITY COEFFICIENTS OF BORON 10 IN ZPR III, VERA, ERMINE, AND MASURCA ASSEMBLIES. Heindler, M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13-Saint-Paul-les-Durance (France). Dept. de Physique des Reacteurs et de Mathematiques Appliquees). Oct. 1973. 79p. (In French). Dep. NTIS (US Sales Only) $8.00.

A comparison is given of the measured and calculated central reactivity coefficients of ^{10}B (in natural and enriched boron and boron carbide samples) in 20 ZPR III and 4 Vera assemblies, in Ermine and Masurca. The calculations were performed through

use of the Cadarache Cross Section Set Version 2. An attempt was made to find a better approximation for the spatial self-shielding in cylindrical and plane samples than that of the second order (method by Kuesters and Khairallah). Conclusions are drawn on reactivity calculations for boron as absorbing element in fast reactor assemblies. 44 references. (auth)

34257 (CNEA-364) REACTIVITY METER. Tapia Guevara, A. B.; Dall'Osto, F. F. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1973. 21p. (In Spanish). Dep. NTIS (US Sales Only) $4.25.

A reactivity meter for normal and excess reactivity, defined as $\rho = (k_{eff}-1)/k_{eff}$ and $\delta k = k_{eff}-1$ respectively, is described. It was constructed with solid state elements (transitors, integrated circuits, and FET). The calibration of the RA-2 and RA-3 control rods was accomplished with this instrument, and graphs of the control rod worths were obtained. The results agree with those obtained by other methods such as period and pulsating source methods. (tr-auth)

34258 (COO-2426-6) PROOF TESTING PROTOTYPE CARBIDE FUEL IN FTR. Vitti, J. A.; Doherty, P. K.; di Lauro, G. F.; Gilbertson, J. C.; Stuteville, D. W. (Combustion Engineering, Inc., Windsor, Conn. (USA)). 1974. 5p. (CONF-741017-14). Dep. NTIS $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

A comparison is presented for prototypical commercial LMFBR carbide fuel design and performance parameters and FTR carbide test assembly operating conditions and carbide fuel designs that are compatible with FTR driver positions. 3 references. (DCC)

34259 (GSF-P-52) COMMISSIONING OF THE NEUHERBERG RESEARCH REACTOR (FRN). Rau, G.; Demmeler, M.; Weber, J.; Kreiner, H. J. (Gesellschaft fuer Strahlen-und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Physikalisch-Technische Abt.). Aug 1973. 39p. (In German). INIS.

22 figs.; 12 tabs.; 3 refs.; with app. With abstract.

A report on the various steps in the commissioning of the Neuherberg research reactor is presented. The start-up tests proceeded without incident as scheduled, thus proving the operating safety of the plant. (GE)

34260 (HEDL-TME-71-91) IRRADIATION TEMPERATURES IN ROW II OF EBR-II. Straalsund, J. L.; Fish, R. L.; McDaniel, P. K.; Cummings, W. V. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1971. Contract AT(45-1)-2170. 41p. AT.

Analyses of thermal monitors from HEDL experiments irradiated in Row II of the EBR-II are presented. Effective gamma heat curves for this row are generated and applied to HEDL experiments that did not contain thermal monitors to calculate irradiation temperature. 6 references. (auth)

34261 (HEDL-TME-71-91(Add.)) IRRADIATION TEMPERATURES IN ROW 7 OF EBR-II. Fish, R. L.; Straalsund, J. L.; McDaniel, P. K. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jul 1971. Contract AT(45-1)-2170. 18p. AT.

The analysis of melt pellet thermal monitors from HEDL experiments irradiated in Row 7 of the EBR-II is presented. Effective gamma heat curves for this row are generated and applied to HEDL experiments from this row to calculate irradiation temperatures. (auth)

34262 (ORNL-TM-4636) SPECTRUM OF GAMMA RAYS WITH ENERGIES GREATER THAN 1.8 MeV PRODUCED BY FISSIONS AND SHORT-LIVED FISSION PRODUCTS IN THE HEALTH PHYSICS RESEARCH REACTOR. Thorngate, J. H.; Christian, D. J.; Summer, G. K. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. Contract W-7405-eng-26. 47p. Dep. NTIS $5.50.

That part of the gamma-ray spectrum with energies >1.8 MeV produced by fissions and short-lived fission products in the Health Physics Research Reactor was measured using a scintillation spectrometer which recorded a pulse only when a pair production interaction occurred and both annihilation quanta escaped the detector. This constraint was chosen to eliminate pulses produced by direct neutron interactions with the detector. An elaborate electronic system was required. Measurements were made at 3 m from the center of the core of the reactor with no shield and with a Lucite or steel shield located at 2m between the reactor and the detector. These shields are commonly used to modify the spectrum produced by the reactor during measurements to intercompare nuclear accident dosimetry systems. A simple gamma-ray spectrum was obtained that decreases exponentially with increasing energy. This shape is, no doubt, the result of the large number of gamma rays produced by the fission process and by short-lived fission products coupled with the many scatters the gamma rays can undergo in leaving the high density core of the reactor. (auth)

34263 (PTB-FMRB-53) DETERMINATION OF THE ^{235}U BURNUP BY REACTIVITY MEASUREMENTS IN THE FMRB. Hollnagel, R. (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany). Forschungs- und Messreaktor). Jul 1974. 23p. (In German). Dep. NTIS (U. S. Sales Only) $4.25.

The ^{235}U burn-up in four fuel elements was determined by reactivity measurement in the core. To convert the reactivity changes into nuclear fuel burn-up, the reactivity changes by cadmium absorbers were determined. The conversion of reactivity differences to burn-up turned out to be of considerable uncertainty. To clarify the situation the reactivity change brought about by a known mass of ^{235}U-fuel should be measured. (auth)

34264 (SAND-74-5191) FLUX DEPRESSION CHARACTERISTICS OF A LARGE CAPACITY TRIGA-FUEL STORAGE CONTAINER. Philbin, J. S.; Estes, B. F.; Morris, F. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 5p. (CONF-741017-10). Dep. NTIS $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

Analysis of the ninety-element fuel storage container in use at Sandia Laboratories' Annular Core Pulse Reactor (ACPR) was performed to characterize its subcritical multiplication properties under full and partial loading conditions. Neutron transport calculations were performed with the DTF-IV code (S_N transport theory) and 16 energy group cross sections. Experimental verification exists for some of the calculated arrays but the limited number of fuel elements available (40) prevented a full loading of the storage container. 10 references. (auth)

34265 (WAPD-TM-1101) ^{233}U OXIDE–THORIUM OXIDE DETAILED CELL CRITICAL EXPERIMENTS (LWBR DEVELOPMENT PROGRAM). Smith, G. G.; Semans, J. P.; Mitchell, J. A. (eds.). (Bettis Atomic Power Lab., Pittsburgh, Pa. (USA)). Oct 1974. Contract AT(36-1)-GEN-14. 95p. Dep. NTIS $8.00.

A critical assembly known as the detailed cell was constructed as part of the Light Water Breeder Reactor (LWBR) Development Program to provide basic experimental data and to confirm nuclear analysis methods. A unique feature of the critical mock-up is the capability to move the entire seed assembly remotely. Experiments were conducted with different seed and blanket configurations, and extensive three-dimensional power distribution measurements were performed. (20 references) (auth)

34266 (WARD-NA-3045-14) EFFECTS OF INTERSTITIAL TRANSFER ON THE MECHANICAL BEHAVIOR OF FAST FLUX TEST FACILITY INTERMEDIATE HEAT EXCHANGER TUBING. Soo, P.; Shiels, S. A.; Orbon, S. J. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). 1974. Contract AT(11-1)-3045. 36p. AT.

A study was made of the effects of interstitial transfer on the mechanical properties of Fast Flux Test Facility intermediate heat exchanger tubing. Over the anticipated 20-year lifetime, the hotter regions of the tubing are likely to lose interstitials and the cooler regions will probably show significant interstitial absorption. In the hotter tubing regions the carbon content will decrease below the minimum of 0.04 weight percent specified in ASME Code Case 1331-8. However, the accompanying loss in yield and tensile strength is unlikely to cause a major design problem. For creep behavior, sodium exposure will decrease the S_t design stress by about 11 percent at end-of-life. With respect to fatigue properties, sodium effects in the high-temperature tubing regions are likely to be beneficial. In cooler tubing regions where interstitial absorption occurs decreases in fatigue life could arise. (13 references) (auth)

34267 FAST-THERMAL CRITICAL ASSEMBLY P-ANNA-1. Adamski, L.; Bukowski, K. Nukleonika; 19: No. 6, 565-574(1974). (In Russian).

Two-zone critical assembly containing natural uranium metal in the central zone is described. The following parameters have been measured: critical masses, reaction rate distributions, fast neutron spectra, and reactivity of hydrogen-containing moderators in central zone. The results of measurements are compared with the results of calculations performed using BNAB-26 and BNAB-70 multigroup constants. 8 references. (auth)

34268 REACTOR IRRADIATION RIGS. Chamrad, B. Nukleon; No. 4, 3-6(1973). (In Czech).

The informative article on the work of the group concerned with irradiation experiments describes generally the rigs for irradiation of materials in the VVR-S reactor, explains their function and operation. In the conclusion the irradiation rigs and auxiliary

equipment developed in the Nuclear Research Institute, Řež, are briefly described. 5 references. (auth)

34269 MEASUREMENTS AT THE CRITICAL FACILITY FOR THE IN-CORE THERMIONIC REACTOR AND COMPARISON WITH CALCULATIONS. Bloser, M.; Kirch, N.; Krings, F. J.; Naseband, A.; Paul, N. (Nuclear Research Center, Juelich, Ger.). Nucl. Sci. Eng.; 55: No. 2, 129-146(Oct 1974).

In-core thermionic reactors (ITR) contain in-core materials which are very unusual in reactor physics. For this reason and due to the compact and very heterogeneous structure of such reactors, critical experiments for an ITR prototype were carried out. Different core configurations with measurements of critical masses, reactivity worths, fluxes, and power distributions also provided the opportunity to test methods of computation, special nuclear data, and measuring methods on a more general basis. (auth)

34270 NEUTRON SCATTERING FACILITIES AT THE FRJ-2 REACTOR IN JUELICH. Schmatz, W. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Festkoerperforschung). No. 4, 3-15(1973). (In English, German).

13 figs.

The facilities for neutron scattering at the Juelich FRJ-2 reactor (DIDO) are used by scientists of the Institut fuer Festkoerperforschung, often in cooperation with external users, in particular from the universities. A brief review is presented on these facilities, their characteristics, and typical applications which cover a wide field of solid state physics and chemistry. At present, four different neutron spectrometers for inelastic scattering are in operation; another is under construction. Furthermore, there are two different instruments dealing with disorder scattering. A combination of a powder and a single crystal diffractometer is under the scientific responsibility of the Institut fuer Mineralogie of the University of Bonn. Another diffractometer, at the FRJ-1 reactor, is used by the Max-Planck-Institut fuer Eisenforschung. Five of the above-mentioned instruments are connected to the liquid-hydrogen source in the FRJ-2 reactor. (GE)

34271 PRODUCTION OF ULTRACOLD NEUTRONS IN BBP-K STATIONARY REACTOR. Akhmetov, E. Z.; Kaipov, D. K.; Konks, V. A.; Lushchikov, V. I.; Pokotilovski, Yu. N.; Strelkov, A. V.; Shapiro, F. L. At. Energ. (USSR); 37: No. 1, 35-38(Jul 1974). (In Russian).

A source of ultracold neutrons, formed in a horizontal tangent through-channel of a BBP-K stationary reactor, is described. The counting rate of UCN with converters of H_2O, Al, Mg, Zr and $H_{1.92}$, the dependence of UCN yield on the temperature of a Mg-converter, and the mean time of UCN propagation along the neutron guide tube from converter to detector are given. Methods of increasing UCN yield are considered. (9 references) (auth)

34272 HEAVY-WATER ZERO POWER REACTOR TR-O. Vorisek, M.; Hron, M. (Inst. of Nuclear Research, Rez, Czech.). Nukleon; No. 1, 5-10(1973). (In Czech).

The TR-O heavy-water zero power reactor, installed at the Institute of Nuclear Research in Rez, is described and its basic parameters are presented. (Nucl. Sci. Abstr. Czech.)

34273 ASSISTANCE OF THE INSTITUTE OF NUCLEAR RESEARCH IN THE CONSTRUCTION AND COMMISSIONING OF A-1, THE FIRST CZECHOSLOVAK NUCLEAR POWER PLANT. Vorisek, M. (Inst. of Nuclear Research, Rez, Czech.). Nukleon; No. 1, 13-16(1973). (In Czech).

The work carried out at the Institute of Nuclear Research in the construction and commissioning of the first Czechoslovak nuclear power plant A-1 is briefly characterized, mainly the work related to the use of the heavy-water reactor TR-O and of the VVR-S reactor gas loop. (Nucl. Sci. Abstr. Czech.)

34274 STANDARD FOR THE DEVELOPMENT OF TECHNICAL SPECIFICATIONS FOR RESEARCH REACTORS. Hinsdale, IL; American Nuclear Society (1974). 15p. (ANSI-N-378-1974; ICONS-01811).

A guide is presented which identifies the following substantive areas: (1) safety limits and limiting safety system settings, (2) limiting conditions for operation, (3) surveillance requirements, (4) design features, (5) administration, and (6) bases for technical specifications. (DG)

34275 RADIATION LOOP WITH ACTIVITY GENERATOR MADE OF FLAT TUBULAR ELEMENTS: IRT REACTOR OF THE TOMSK POLYTECHNIC INSTITUTE. Gefsimanskii, E. P.; Kuznetsov, S. A.; Kulagin, Yu. G.; Sakharov, E. S.; Skorikov, A. G.; Chuchalin, I. P. Sov. At. Energy (Engl. Transl.); 35: No. 6, 1132-1134(Dec 1973).

Translated from At. Energ. (USSR); 35: No. 6, 430-432(Dec 1973).

A physical description of the γ ray activity generator is provided together with a cartogram of the core loading pattern and a flowsheet of the radiation loop. Performance specifications are also given. (DG)

34276 MUTUAL SCREENING OF γ-CARRIER LAYERS IN MULTILAYER RADIATION-CONTOUR-ACTIVITY GENERATORS. Sakharov, E. S.; Chuchalin, I. P. Sov. At. Energy (Engl. Transl.); 35: No. 6, 1135-1137(Dec 1973).

Translated from At. Energ. (USSR); 35: No. 6, 432-433(Dec 1973).

Experimental studies of the mutual-screening coefficient of indium layers of various thicknesses in water moderator carried out at the IRT reactor are described. Data are presented for two-, three-, and multilayer activity generator models with various layer spacings in a thermal neutron field. (DG)

34277 DYNAMICS OF FUEL IN A PULSED REACTOR. Temperature Shocks in Rods Made from Pellets. Lomidze, V. L. Sov. At. Energy (Engl. Transl.); 35: No. 2, 747-748(Aug 1973).

Translated from At. Energ. (USSR); 35: No. 2, 125-126(Aug 1973). This is a summary of paper No. 682/7056 with full copy held at TIC.

The problem of the rapid heating of a thin fuel rod of length L, consisting of a large number of elastic pellets is considered. The effect of the dynamics of pellets that disintegrate as a result of the temperature shock on the kinetics of the pulsed reactor is investigated. (auth)

34278 DYNAMICS OF FUEL IN A PULSED REACTOR. Oscillations of a Rod with a Shell. Lomidze, V. L. Sov. At. Energy (Engl. Transl.); 35: No. 2, 746-747(Aug 1973).

Translated from At. Energ. (USSR); 35: No. 2, 123(Aug 1973). This is a summary of paper No. 681/7055 with full copy held at TIC.

In the fast (~100 μsec) extraction of heat in the fuel of a pulsed reactor, the temperature expansion of the material is counteracted by inertial forces, which are the cause of the oscillations and stresses in the fuel rods and the support structures. The dynamics of a fuel element under conditions characteristic of a pulsed reactor are investigated. (auth)

Production and Materials Testing and Processing Reactors

Refer also to abstract 34165.

34279 GENERATION OF HYDROGEN AND CARBON MONOXIDE-RICH GASES FROM METHANE BY MEANS OF AN INTERMEDIATE LEAD CYCLE FOR HEAT TRANSFER FROM A HIGH-TEMPERATURE REACTOR AND ITS UTILIZATION IN THE REDUCTION OF IRON ORE. Stolzenberg, G. Aachen, Ger.; Technische Hochschule (1973). 163p. (In German). INIS.

Thesis. 56 figs.; 5 tabs.; 101 refs. With abstract. Available from the library of the Technische Univ., Aachen.

The advantages and disadvantages of an intermediate lead cycle are discussed. By means of the thermodynamic equilibria it is shown that a gas which can immediately be used for the reduction of iron can only be produced at pressures below 5 atm by the splitting of methane with steam or carbon dioxide. It has been proved by experiments that a considerable approximation to the calculated equilibrium analyses is obtained with catalytic splitting of methane in the tube after a contact time of a few tenths of a second. Experiments to convert methane with steam in lead bubble columns on the other hand, yielded reduction gases of an inferior quality. The gases produced in the tube can be advantageously used in chosen processes. Various individually calculated stationary gas cycles permit an extensive use of the reduction gases. From the data for heat transfer in lead-gas tube heat exchangers, it can be seen that the type of exchanger can be very compactly constructed. The physical basis for the calculation of bubble heat exchangers are obtained. (GE)

Propulsion and Package Reactors

Refer also to abstract 34394.

34280 (GKSS-74/E/16) THE ZERO POWER EXPERIMENT WITH THE SECOND CORE OF THE NUCLEAR SHIP "OTTO HAHN". Krull, W. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany). Zentralabteilung Forschungsreaktoren). 1974. 8p. (In German). INIS.

9 figs.; 5 tabs.; 13 refs. With abstract in English. Published in Atomkernenergie (1973) v. 22(3) p. 147-154.

The zero power experiments with the second core of the Otto Hahn Reactor are described. Experiments done are: critical experiments, symmetry examination, calibration of the control rods, reactivity measurements (shut down, stuck rod, temperature coefficient, coupling, excess reactivity with boric acid poisoning, measurements using the pulsed neutron technique, and control rod curves). Measurements including thermal neutron flux distribution were done in one fuel element. Special core configurations of FDR fuel elements have been investigated. Measurements of the reactivity worth up to -45 using the pulsed neutron technique are discussed. The measurements are compared with calculations using diffusion theory. (auth)

34281 (GKSS-74/E/18) COMMISSIONING OF THE 2ND CORE OF THE FDR. Brodale, V.; Kolb, M.; Robinson, E.; Schwieger, E.; Voeltzer, G. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). 1974. 4p. (In German). INIS.

6 figs.; 1 tab.; 7 refs. With abstract in German and English. Published in Atomkernergie v. 22(3) p. 165-168, 1973.

The commissioning of the N. S. Otto Hahn reactor with the second core is described. Results are presented for the first nuclear start-up, the measurement of the isothermal temperature reactivity coefficient, the self-regulating properties, the load change transients, and the switching of one of the three primary coolant pumps. (auth)

34282 (GKSS-74/E/19) ANALYSIS OF ZERO ENERGY EXPERIMENTS FOR THE SECOND CORE OF THE "OTTO HAHN". Buenemann, D.; Justin, J.; Siewers, H.; Mueller, E. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). 1974. 4p. (In German). INIS.

2 figs.; 1 tab.; 10 refs. With abstract in German and English. Published in Atomkernenergie v. 22(3) p. 155-158(1973).

The theoretical methods for reactor core calculations applied to the critical experiment of the second core of the "Otto Hahn" are described. The analysis and interpretation of the experiment demonstrates that a satisfying accuracy of theoretical predictions is obtained. (auth)

34283 (GKSS-74/E/22) SECOND CORE OF THE NS OTTO HAHN. Manthey, H. J. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R Germany)). 1974. 56p. (In German). Dep. NTIS (U. S. Sales Only) $6.00.

Design parameters for the second core of the Otto Hahn Reactor are presented. (8 references) (DCC)

34284 (GULF-GA-A12397) DEVELOPMENT OF A THERMIONIC REACTOR SPACE POWER SYSTEM. Summary Report for Period July 1, 1972-October 31, 1972. (Gulf General Atomic Co., San Diego, Calif. (USA)). 15 Jun 1973. Contract AT(04-3)-840. 226p. Dep. NTIS $14.50.

Progress is reported in the following areas: (1) thermionic research in out-of-core testing and diagnostic method development, (2) material technology of fuel, cladding, seals, trilayers, and joints, (3) thermionic fuel element design, fabrication, and testing, (4) thermionic reactor design and testing, and (5) thermionic power system design and analysis. (DG)

34285 (GULF-GA-A-12608) DEVELOPMENT OF A THERMIONIC REACTOR SPACE POWER SYSTEM. Final Summary Report. (Gulf General Atomic Co., San Diego, Calif. (USA)). 30 Jun 1973. Contract AT(04-3)-840. 422p. Dep. NTIS $24.25.

Information on the development of thermionic space power reactors is presented concerning thermionic research, materials technology, thermionic fuel element development, reactor technology, and systems technology. (DCC)

34286 (LA-5679) PRELIMINARY STUDY OF PLASMA NUCLEAR REACTOR FEASIBILITY. Helmick, H. H.; Jarvis, G. A.; Kendall, J. S.; Latham, T. S. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1974. Contract W-7405-eng-36. 14p. Dep. NTIS $4.00.

An engineering working group was formed by the National Aeronautics and Space Administration to assess the feasibility of performing a series of nuclear cavity reactor critical experiments which would provide basic reactor physics and engineering data for future higher power gaseous UF_6 and uranium plasma core reactor experiments. The joint engineering working group comprised personnel from the Los Alamos Scientific Laboratory and the United Aircraft Research Laboratories. Included in the scope of the investigations were estimates of costs and the establishment of a test schedule for the cavity reactor experiments. In addition, residual materials and test facilities formerly used for the solid core nuclear rocket development programs were inventoried and inspected to determine their suitability for use in the series of cavity reactor experiments. The principal conclusions of the study are that (1) residual beryllium reflector segments, control drums and drive motors, and a pressure vessel from the solid core nuclear rocket development program can be assembled in the LASL Critical Experiments Facility to perform initial cavity reactor experiments at minimum cost, and (2) the Remote Maintenance, Assembly, and Disassembly building at the Nuclear Rocket Development Station is an ideal facility in which to perform future high-power reactor experiments. 16 references. (auth)

34287 NUCLEAR NAVY, 1946-1962. Hewlett, R. G.; Duncan, F. Chicago; University of Chicago Press (1974). 489p. $12.50.

A comprehensive history of the application of nuclear power to submarine and surface-ship propulsion is presented. The study covers the period from the discovery of the fission process in 1939 to 1962, when the Navy's nuclear fleet had grown to twenty-seven submarines and three surface ships. The roles played by various individuals, institutions, and agencies in developing the nuclear propulsion systems are examined in detail. (DG)

Reactor Safety and Environmental Aspects

Refer also to abstracts 31613, 32021, 32024, 32034, 32035, 32045, 32047, 32058, 32093, 32096, 32131-32138, 32187, 34229, 34416, and 34462.

34288 (AED-CONF-74-066-001) STATE OF THE ART IN THE FIELD OF PROPAGATION DISTURBANCES. Schleisiek, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung). 1974. 8p. (In German). (CONF-740345-1). INIS.

From fast breeder project conference; Karlsruhe, F. R. Germany (26 Mar 1974).

11 figs.; 8 refs.

The report deals with the work carried out in the Nuclear Research Center Karlsruhe for investigating the propagation problem. Individual items discussed are unit disturbances, local and integral boiling, studies on fuel-sodium reactions, and integral detection methods. (GE)

34289 (CENPD-132(Rev.01)(Vol.1)) CALCULATIONAL METHODS FOR THE C-E LARGE BREAK LOCA EVALUATION MODEL. Volume I. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Aug 1974. 459p.

The development of the loss of coolant analytical models that have taken place over the past 8 years are described. The new analytical model is described in terms of how the various computer programs are employed to perform a LOCA-ECCS analysis. In addition, compliance with each of the five LOCA criteria is indicated. The following programs are mentioned: BARF, RELAPSE-I, RELBOT, ZIRST, FLASH, FLASH-2, MODFLASH-2, FLASH-4, CEFLASH-4, STRIKIN, FATES, and PERC. (auth)

34290 (CENPD-132(Rev.01)(Vol.2)) CALCULATIONAL METHODS FOR THE C-E LARGE BREAK LOCA EVALUATION MODEL. Volume II. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Aug 1974. 267p.

The results of parametric studies that were performed to justify the selected parameters and analytical models employed for the C-E-LOCA analytical procedure are provided. (auth)

34291 (CENPD-133(Rev.01)) CEFLASH-4A, A FORTRAN IV DIGITAL COMPUTER PROGRAM FOR REACTOR BLOWDOWN ANALYSIS. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Aug 1974. 197p.

The CEFLASH-4A digital computer program calculates the thermal-hydraulic response of a water cooled reactor system during a loss-of-coolant accident by performing a numerical integration of the one-dimensional equation for the conservation of mass, energy, and momentum using a node-flow path network to "model" the reactor system. The hydraulic transient of the reactor is coupled to the thermal response of the core by analytically solving the one-dimensional radial heat conduction equation in a core node. The system pressure and enthalpy are obtained by performing a search of steam table data under the assumption of thermodynamic equilibrium. The major improvements in the CEFLASH-4A program are: (1) the energy and momentum equations have been generalized to include all important effects; (2) the pressure search has been improved and now gives uniform convergence for all coolant states; (3) the pump model has been upgraded and is now based on homologous

relationships between pumps of similar speeds; (4) the heat conduction model used in the core is based on an "N" region solution of the cylindrical heat conduction equation; (5) the energy transfer between the fuel rod and coolant is now dependent on the heat transfer regime at the rod surface conditions, and all heat transfer regimes are permitted and selected on a dynamic basis; (6) cross flow in the core can be modeled; and (7) core blockage due to rod swelling and rupture is accounted for. (auth)

34292 (CENPD-133(Rev.01)(Suppl.1)) CEFLASH-4AS, A COMPUTER PROGRAM FOR REACTOR BLOWDOWN ANALYSIS OF THE SMALL BREAK LOSS OF COOLANT ACCIDENT. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Aug 1974. 30p.

A description is provided of modifications to the CEFLASH-4A computer code which were required in order to enable the code to be employed for analysis of loss of coolant accidents in which phase separation effects are important. Several of these changes require specification of various geometric parameters associated with the particular plant being analyzed. The present version of the modified computer code, designated CEFLASH-4AS, does not allow certain of these parameters to be specified through the code input. Rather, these parameters are specified by minor changes of data statements internal to the code. These changes do not affect the computational procedures within the code but merely modify numerical values of parameters used in the calculations. (auth)

34293 (CENPD-135(Rev.01)) STRIKIN-II, A CYLINDRICAL GEOMETRY FUEL ROD HEAT TRANSFER PROGRAM. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Aug 1974. 148p.

An analysis is presented of a Fortran IV digital computer program used to calculate the core hot spot transient clad temperature during the blowdown, refill, and reflood regimes of a loss-of-coolant accident. The program solves the one-dimensional (axial) energy conservation equation and the equations of state for the fluid with provisions for local fluid expansion. Tabular time-dependent functions of flow rate, channel pressure, fluid enthalpy, normalized heat generation rate, and reflood heat transfer coefficients are required inputs for the code. (auth)

34294 (CENPD-137(Rev.01)) CALCULATION METHODS FOR THE CE SMALL BREAK LOCA EVALUATION MODEL. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Aug 1974. 241p.

A description of the model presently employed by CE for analysis of a small break loss-of-coolant accident is presented which includes all features of the model which are pertinent to the results of the analysis. In general, features which are unique to analysis of a small break LOCA are described in detail. Features of the computer codes which are unique to small break analysis are also discussed. (auth)

34295 (CENPD-138(Rev.01)) PARCH: A FORTRAN IV DIGITAL COMPUTER PROGRAM TO EVALUATE POOL-BOILING AXIAL ROD AND COOLANT HEATUP. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Aug 1974. 77p.

PARCH is a pool boiling axial rod and coolant heatup code developed for use in the small break loss of coolant accident (LOCA) analysis. Transient fuel rod temperatures are obtained from either the STRIKIN-II or PARCH codes. STRIKIN-II, a forced convection code, is used during the early blowdown period when the system flow rates are high. The later portion of the small break blowdown and the refill periods are characteristically quiescent. The core behaves as a boiling pot with a time-varying two-phase level. The PARCH code, which utilizes the core two-phase level and pool boiling heat transfer correlations, is used in the temperature calculations during this quiescent period. Although PARCH was designed specifically for the small break LOCA analysis, it is more generally applicable to any fuel rod heatup problem defined by pool boiling heat transfer and a time varying two-phase level. The geometric model and the prominent features incorporated into PARCH are described. These features include: (1) pool boiling heat transfer, (2) heat transfer logic restrictions, (3) level dependent fuel rod heatup, (4) variable gap conductance, (5) clad rupture and swelling, (6) zirconium-water reaction, and (7) time-varying material properties. The calculational procedure employed in PARCH is outlined. The equations solved by PARCH are presented along with descriptions of the heat transfer correlations, heat transfer logic, and subroutines called by PARCH. A detailed description of the PARCH input and output is included. (auth)

34296 (CENPD-148) REVIEW OF REACTOR SHUTDOWN SYSTEM (PPS DESIGN) FOR COMMON MODE FAILURE SUSCEPTIBILITY. Moreau, R. J. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Sep 1974. 91p.

A review of Combustion Engineering's Protective System (PPS Design) has been made with the "aim of identifying areas that might be particularly vulnerable to common mode failures". The study encompassed primarily the equipment furnished by C-E, but also considered the effects of balance of plant equipment. The systematic approach which was utilized assumed various types of common mode failures individually in all reactor protective system safety components, evaluated the safety consequences of such failures, and postulated potential reasons for the common mode failure. The resulting list of potential common mode failures included many items which have satisfactory mitigating factors or are considered improbable in view of past history and engineering judgement. Thus, some failures, after individual consideration, have been adjudged not "particularly vulnerable" and not deemed to represent a realistic safety problem. A sizeable list of potential common mode failures remains, including those caused by events such as miscalibration, operator error, excessive environmental conditions, electric bus problems, or layout of equipment within a plant. These specific items are enumerated in the report. A review by personnel of the individual plants involved is required to evaluate the possibility and potential of each of these items. (auth)

34297 (IRS-F-19) REPORTS ON RESEARCH PROJECTS IN THE FIELD OF REACTOR SAFETY SUPPORTED BY THE BUNDESMINISTERIUM FUER FORSCHUNG UND TECHNOLOGIE. Reporting Period: October 1 – December 31, 1973. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). Mar 1974. 278p. (In German). INIS.

With figs., tabs., and refs.

Progress in reactor safety research is reported. Included is information on work accomplished, results produced, and planning of future work. (TSS)

34298 (IRS-F-20) REPORTS ON RESEARCH PROJECTS IN THE FIELD OF REACTOR SAFETY SUPPORTED BY THE BUNDESMINISTERIUM FUER FORSCHUNG UND TECHNOLOGIE. Reporting Period: January 1 – March 31, 1974. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). Jul 1974. 247p. (In German). INIS.

With figs., tabs., and refs.

Progress in reactor safety research is reported. Included is information on work accomplished, results produced, and planning of future work. (TSS)

34299 (NEDO-20626) STUDIES OF BWR DESIGNS FOR MITIGATION OF ANTICIPATED TRANSIENTS WITHOUT SCRAM. Claassen, L. B.; Eckert, E. C. (General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.). Oct 1974. 36p. (74-NED-59).

Studies performed as required by the AEC in the WASH 1270 document dealing with the postulated total failure of the scram system are described. In particular, these studies address the plants listed as Class 1.B in Appendix B of WASH 1270, for which an evaluation of performance is required showing the capability to acceptably mitigate the consequences of anticipated transients without scram (ATWS) within limits imposed by the AEC. The effectiveness of the recirculation pump trip feature previously identified is reconfirmed, however, additional consideration of standby liquid control initiation is presented for reduction of the severity of the containment duty resulting from the postulated event. The transients evaluated are based on per unit generic analyses representative of all plant sizes and all BWR product lines included in the Class B plant. (auth)

34300 (NP-20109) SHALL WE STAKE ON ATOMIC POWER? Reproduction of a Series of Informative Articles from Ingenioerens Ugeblad 1973–1974. 1974. 74p. (In Danish). Dep. NTIS (US Sales Only) $6.75.

A collection of 34 articles by 21 authors dealing with problems relating to the introduction of nuclear power stations in Denmark is presented. Emphasis is placed on information and reference material. (DE)

34301 (NP-20164) PREPARATION OF ENVIRONMENTAL REPORTS FOR NUCLEAR POWER PLANTS. Philbin, T. W.; Halvorsen, J. V. (Eds.). (Atomic Industrial Forum, Inc., New York (USA)). [nd]. 34p.

The four papers presented at the meeting discussed the preparation, review, and evaluation of environmental impact statements which deal with the impact of building and operating nuclear power plants. (LCL)

34302 (ORNL-TM-4630) LMFBR SAFETY AND CORE SYSTEMS PROGRAMS PROGRESS REPORT, JANUARY–MARCH 1974. Fontana, M. H. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 108p. AT.

Program review, coordination, and planning activities are

reported. Progress is reported under the headings: (1) analysis and data evaluation for Fuel Failure Mockup (FFM) bundles 5A and 5B, (2) water system mockup of the FFM, (3) development of coolant channel blockage detection methods, (4) FFM facility operations, and (5) LMFBR electric heater and LWR fuel pin simulator development. (DG)

34303 (ORNL-TM-4740) DEVELOPMENT OF MODELS FOR THE EVALUATION OF TEMPERATURES IN A HTGR CORE FOLLOWING A LOSS OF FORCED CIRCULATION AND SIMULTANEOUS REACTOR TRIP. Sanders, J. P.; Siman-Tov, I. I. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. Contract W-7405-eng-26. 69p. (CF-73-9-25). Dep. NTIS $6.50.

Some intermediate conclusions resulting from an analysis of Loss of Forced Circulation (LOFC) accident models in a High Temperature Gas-Cooled Reactor (HTGR) are presented. It is shown that conduction through the active core and radiation across the helium spaces between fuel elements have little effect on the maximum temperatures calculated for the first several hours after a simultaneous LOFC and reactor trip. Temperatures that result in thermal degradation of the fuel are reached within this period of time; therefore, the need for a more detailed representation of the thermal conductivities of the core is not necessary. The temperature differences between the fuel and the graphite that exist during power operation of the reactor were found to decrease very rapidly after reactor trip, allowing one to treat the active core as a homogeneous material with composite properties. (auth)

34304 (SRD-R-30) SECOND SURVEY OF DEFECTS IN PRESSURE VESSELS BUILT TO HIGH STANDARDS OF CONSTRUCTION AND ITS RELEVANCE TO NUCLEAR PRIMARY CIRCUITS. Smith, T. A.; Warwick, R. G. (UKAEA Safety and Reliability Directorate, Culcheth). 1974. 35p. Dep. NTIS (US Sales Only) $4.75. UK £1.00.

Data gathered by the Associated Offices Technical Committee and the UKAEA Safety and Reliability Directorate on reported pressure vessel failures are analyzed, categorized, and tabulated, and a survey of British and American primary coolant circuit defects and failures is presented for comparison with fossil fuel power plants of relevant construction and service. Potential and catastrophic failure probabilities are included for various plant categories. (DG)

34305 (SSI-1974-012) CONSIDERATIONS CONCERNING RESTRICTIONS FOR BUILDING WITHIN THE AREA OF A NUCLEAR POWER STATION. Snihs, J. O. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Mar 1974. 8p. (In Swedish). Dep. NTIS (US Sales Only) $4.00.

Releases from nuclear power stations under normal operation are considered in relation to building up the dose environment. The conclusions are that the releases under normal operation are not a reason for building restrictions. However, it is said that the risk from reactor accidents is a motive for building restrictions. A big population (over 10,000 people) should not live within about 10 km from a nuclear power station as this will cause difficulties in organizing preparation for evacuation and delivering iodine tablets. (SW)

34306 (SSI-1974-015) PREPAREDNESS AGAINST ATOMIC ACCIDENTS IN SWEDEN. Lindhe, J. C. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Apr 1974. 7p. (In Swedish). Dep. NTIS (US Sales Only) $4.00.

A short description is given of the different authorities in Sweden responsible for giving advice on radiation protection of personnel and population in case of an atomic accident. The administrative organization of the authorities is described, as well as the alarm system. (SW)

34307 (TID-26627) TEST OBJECTIVES AND TEST FACILITY DETAILS: MARK III PRESSURE SUPPRESSION TEST. Hinds, J. A. (General Electric Co., San Jose, Calif. (USA). Nuclear Energy Div.). 19 Dec 1973. 16p. Dep. NTIS $4.00.

The test program schedule and objectives of the program planned for 1974/1975 are presented. The tests are designed to provide data for analytical model verification and to obtain exploratory information needed in the design of pressure suppression containment systems. (DG)

34308 (TRG-Report-2497(W)Pt.1) IODINE SORPTION PLANT TEST PROCEDURES IN THE UNITED KINGDOM. Hillary, J. J. (UKAEA Reactor Group, Sellafield). Feb 1974. 18p. (CONF-731218-2). Dep. NTIS (US Sales Only) $4.00.

From seminar on the testing of iodine filters; Karlsruhe, F. R. Germany (4 Dec 1973).

The United Kingdom approach to performance monitoring of iodine sorption plants combines in-situ testing at full scale with laboratory tests of the sorbent (usually impregnated charcoal) using a realistic labelled iodine compound, methyl iodide-131. Plant performance can then be evaluated under a wide variety of operational conditions difficult to achieve conveniently on the plant. The full-scale test gives a measure both of the extent to which gas may by-pass the charcoal and of the degree of methyl iodide desorption from the charcoal. Laboratory testing is also important in the assessment of in-service performance of the sorbent, to check ageing and possible poisoning effects. In a typical large-scale test, the source is released upstream of the plant. Penetration is measured by withdrawing a proportion of the main gas flow through charcoal samplers situated in upstream and downstream locations and comparing the sampler activities. Considerable experience has been accumulated in the conducting of these large-scale tests with millicurie levels of methyl iodide-131, according to well-developed safety procedures. The laboratory test for iodine sorption materials is carried out with methyl iodide-131 in air at near 100% relative humidity. This represents rather pessimistic operating conditions which can conveniently be achieved reproducibly. Performance is again measured by charcoal samplers. (auth)

34309 (TRG-Report-2497(W)Pt.2) EXPERIENCE AT WINDSCALE OF FULL-SCALE TESTING OF INSTALLED IODINE SORPTION PLANT WITH METHYL IODIDE. Hillary, J. J.; Taylor, L. R. (UKAEA Reactor Group, Sellafield). Feb 1974. 28p. (CONF-731218-3). Dep. NTIS (US Sales Only) $4.50.

From seminar on the testing of iodine filters; Karlsruhe, F. R. Germany (4 Dec 1973).

The installed charcoal bed units of the iodine sorption plants at Windscale have been tested since 1965 with a realistic compound of fission product iodine, methyl iodide-131. The plants incorporate a range of design features and have been installed to perform a variety of duties, namely the control of reactor coolant gas discharge and leakage and hot cell ventilation. The full-scale test experience, combined with supporting laboratory tests on the sorption material (principally impregnated charcoal) also using methyl iodide-131, has sometimes revealed deficiencies in the plant performance. Problems of mechanical by-passing of the charcoal and in one case extensive poisoning have been observed. Rectification measures and further testing were required to prove the satisfactory performance of the plant. By the application of proper safety procedures many tests have been conducted with millicurie levels of iodine-131 activity without causing safety problems. It is concluded that it is essential to carry out full-scale and laboratory testing of iodine sorption plants in order to give confidence in operational performance. Efficient operation also requires careful attention to design specifications which have been improved during the test program, and to supervision during plant installation. (auth)

34310 (UCRL-51543) EXERCISE SUPER-RABBIT, A LIVERMORE POOL TYPE REACTOR DISASTER EXERCISE. Palmer, T. D.; Purington, R. G.; Trolan, R. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 May 1974. Contract W-7405-eng-48. 26p. Dep. NTIS $4.00.

A simulated disaster designed to exercise the LLL Disaster Control Plan, the Livermore Pool Type Reactor (LPTR) Disaster Control Plan, and the various LLL disaster control support organizations and facilities is described. A simulated LPTR experiment, which resulted in damage to the reactor and injuries to reactor personnel, required response to an uncontrollable reactor, rescue and evacuation of contaminated victims in a high radiation field, decontamination of facilities and personnel, and medical attention for injured operations personnel. The exercise required an alert of the LLL emergency response system and subsequent upgrading from a local accident status to that of a major disaster. The LLL Disaster Control Organization and required support units responded and implemented the LLL and LPTR Disaster Control Plans. Evaluation of the response was provided by umpires and followed by a critique of all personnel involved in the exercise. (auth)

34311 (WASH-1319) LAND USE AND NUCLEAR POWER PLANTS. Case Studies of Siting Problems. Ramsay, W.; Reed, P. R. (USAEC Directorate of Regulatory Standards, Washington, D. C.). 1974. 60p. Dep. NTIS $6.00. GPO $0.95.

Four cases are discussed involving nuclear plants (built, proposed, or under construction). These cases are intended to illustrate direct land use impacts on four different types of land: in terms of U. S. Geological Survey Land Classification System these are "Urban and Built-up Lands," "Agricultural Land," "Wetlands," and "Forest Land." Also, an indirect effect on another land type ("Barren Land") is discussed in one of the cases. The cases are treated as follows. Some background of

the project is given, the general region surrounding the site is described briefly, and the characteristics of the site itself are presented. Then the environmental effects of the land use change involved in the power plant project are described: it clarifies the problem in terms of environmental economics to divide these effects up into the direct effects of the land use change, called here "land conversion," and the indirect effects. The indirect effects are called here "spillovers," and cover every kind of "neighborhood effect" from salt deposition from cooling tower drift to increased ugliness from new transmission lines. Finally, the question of supplemental land use is considered, that is the (generally beneficial) use of the site for other purposes in addition to that of power generation. A section of tables is presented giving some statistics and general land use information about a relatively large number of nuclear power plants. (auth)

34312 (WASH-1332(74)(Vol.2), pp 785-824) EXPERIENCES IN DECONTAMINATION/DECOMMISSIONING OF THE ELK RIVER REACTOR. McConnon, D.; Nemec, J. F. (United Power Association, Elk River, MN). 1 Apr 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

The Elk River Reactor (ERR), a 58 MW(t) boiling water reactor, was operated for four years and shut down in 1968 for economic reasons. The facility is now being dismantled in such a way that the reactor site will be returned to approximately the condition that existed prior to installation of the reactor with all vestiges of the reactor plant (except for subgrade foundations) having been removed and disposed of. This is the first time that decommissioning of a power reactor has involved complete removal and disposal of large radioactive structures, rather than in-place entombment. Removal operations and radiological conditions during dismantling of the highly radioactive portions of the reactor are described. The removal sequence of these structures started with the reactor internals and inner thermal shield, progressed through the pressure vessel and outer thermal shield, and ended with the inner sections of the biological shield. Segmentation of the structures, either by mechanical or hot-cutting techniques, and packaging for transportation were done remotely to control personnel exposure with the addition, at times, of temporary shielding. To prevent the spread of contamination to work areas, operations were carried out underwater, or where this was not possible, in a specially designed containment structure around the work area. External exposure received by dismantling personnel was well below the limits specified in 10 CFR 20. Internal radionuclide deposition did not exceed 1% of the applicable maximum permissible body burden. Contamination spreads to work areas were minimal and releases of radioactive material to the environment were controlled well within the established numerical guidelines. (auth)

34313 (WCAP-8330) WESTINGHOUSE ANTICIPATED *TRANSIENTS WITHOUT TRIP ANALYSIS.* (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Aug 1974. 374p.

Anticipated transients were analyzed for Westinghouse PWR's with the unrealistic assumption that a hypothetical, undefined common mode failure prevents reactor trip. The analyses were performed on a generic basis using appropriate parameters representative of operating characteristics of Westinghouse PWR's. The results show that in all cases the DNB ratio is greater than 1.0, and the peak Reactor Coolant System pressure is below the allowable pressure limits. The radiological consequences calculated for these postulated events are well within the guideline values set forth in 10 CFR Part 100. (auth)

34314 UNDERGROUND NUCLEAR PLANT SITING: A TECHNICAL AND SAFETY ASSESSMENT. Crowley, J. H. (United Engineers and Constructors, Inc., Philadelphia); Doan, P. L.; McCreath, D. R. Nucl. Safety; 15: No. 5, 519-534(1974).

The siting of nuclear plants underground is examined broadly on the basis of technical feasibility, design, safety, and economics. Discussion is general for all reactor types and underground siting alternatives, but specific details are mainly referred to a 1000-MW pressurized-water reactor located in a deep rock cavern. Conclusions are that current technology is entirely adequate and that the enhanced safety posture of an underground site may facilitate close-in siting and with no greater risk or possibly less than that of a surface site. Economic trade-offs are identified, and it has not been clearly established that underground siting would result in an economic penalty. 54 references. (auth)

34315 COMPUTER CODES FOR ANALYZING NUCLEAR ACCIDENTS. Winton, M. L. Nucl. Safety; 15: No. 5, 535-553 (1974).

Many computer codes have been developed for use in various aspects of nuclear accident analysis. The Nuclear Safety Information Center has separated over 180 of these codes into 13 groups and tabulated them. The resulting table gives name of code, machine on which it is operable, its language, corporate author, a statement of what the code does, a reference citation, and date of the reference. (auth)

34316 NUCLEAR SAFETY. Volume 15, No. 5. Cottrell, W. B.; Jordan, W. H.; Sheldon M. R. (eds.). Oak Ridge, TN; Oak Ridge National Lab. (1974). 153p.

Separate abstracts are included for 10 articles presented concerning general safety considerations, accident analysis, control and instrumentation, plant safety features, consequences of effluent release, and operating experiences. (DCC)

For abstracts of individual papers see: 32946, 32960, 34131–34134, 34314, 34315, 34407, and 34463.

34317 RADIOACTIVE POLLUTANTS RELEASED IN ACCIDENTS AT LWR POWER PLANTS: REVIEW AND ATTEMPT AT CLASSIFICATION. Hosemann, J. P.; Schikarski, W.; Wild, H. (Kernforschungszentrum, Karlsruhe, Ger.). pp 279-290 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

A brief review is given of the known relevant elementary processes contributing to the reduction of airborne activity inside the reactor containments. Mathematical models that combine these elementary processes are reviewed and their performance discussed relative to the results of scaled experiments. Using the computer program ASP developed at Karlsruhe, the activity inventory of a typical LWR is calculated. These data, together with an estimate of the release fractions and the results of experiment and model on the attenuation in the containments of the different groups of elements, are fed into the computer program MUNDO II which calculates the radiation dose in rem to a standard person at a standard distance from the plant. MUNDO II takes into consideration external radiation from the radioactive discharge cloud as well as that due to inhalation. The connection thus set up for each radioactive isotope between the activity present at the time of the accident and a standardized radiation dose permits, finally, a classification of all radioactive isotopes present in a LWR in order of their radiotoxic importance. (auth)

34318 RECENT DEVELOPMENTS IN PREDICTION OF ENVIRONMENTAL CONSEQUENCES OF RADIOACTIVE RELEASES FROM NUCLEAR POWER REACTORS. MacDonald, H. F.; Darley, P. J.; Clarke, R. H. (Central Electricity Generating Board, Berkeley, Eng.). pp 337-348 of Physical Behavior of Radioactive Contaminants in the Atmosphere. Vienna; International Atomic Energy Agency (1974).

From symposium on the physical behavior of radioactive contaminants in the atmosphere; Vienna, Austria (12 Nov 1973). See STI/PUB-354; CONF-731110-.

In the past few years theoretical models describing the complex pathways from a reactor to man have been developed for the study of siting and safety aspects of nuclear power reactors. Within the Central Electricity Generating Board the computer program WEERIE has been used to evaluate the build-up of fission products in irradiated reactor fuels and to investigate their physical behavior in the reactor and subsequently in the atmosphere following release under defined operational or accident conditions. The WEERIE code and its use in the establishment of improved emergency monitoring procedures at the Board's Magnox power stations has been described previously, and some recent developments in the application of the program to advanced reactor designs are discussed. The nature and magnitude of the radioactive discharges from a reactor operating with a small fraction of failed fuel present in the core have been investigated and a method of evaluating the build-up of activity in the free volume within an irradiated fuel pin is described. Attention is drawn to the differing dosimetric consequences of this component, which is released relatively rapidly on pin failure, and those which arise subsequently due to continuous leakage from the failed pin. Special emphasis has been placed upon the speed of execution for the cloud γ exposure integrations in WEERIE, enabling parametric survey calculations to be undertaken economically, and the results of a study of cloud γ isopleths due to a mixed fission-product release are described. The applications of WEERIE results to the evaluation of population as well as individual doses resulting from nuclear power reactor operation are also outlined. (auth)

34319 FISSION PRODUCT RELEASE AFTER REACTOR SHUTDOWN. Eickelpasch, N. (Kernkraftwerk RWE-Bayernwerk GmbH, Gundremmingen, Ger.); Hock, R. pp 381-399 of Experience

from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

If there are failed fuel pins in a reactor core, activity will be released to the coolant even if the reactor is shut down. Especially in the case of iodine, there is usually a pronounced increase in the release rate shortly after any major power change. Only up to a few days after shutdown will the original concentration of long-lived iodines be reached again. The time schedule of the work to be performed (opening the pressure vessel, etc.) is strongly influenced by this effect. This release and the influence of the shutdown mode on the release was studied at the boiling-water reactor of Gundremmingen. For many years, the activity released from failed fuel elements for some time after shutdown has been used in water-cooled reactor to identify the failed fuel elements. The release of single elements during this period is compared with the overall behavior of the core during the whole shutdown period. (auth)

34320 OPTIMUM ACTIVE–INACTIVE TIMES IN SUPERVISED PROTECTIVE SYSTEMS FOR NUCLEAR REACTORS. Kontoleon, J. M.; Kontoleon, N.; Chrysochoides, N. G. (Democritos Nuclear Research Center, Athens). Nucl. Sci. Eng.; 55: No. 2, 219-224(Oct 1974).

An availability study of a system subject to supervision is undertaken. Selection of the period between successive inspections and the duration of each inspection affects system availability. The presentation makes use of a Markov process, continuous in time and with three discrete states — working, faulty, and under repair. Failure and repair rates are assumed to be exponentially distributed. The problem of optimizing system availability subject to a cost constraint, as a function of supervision period and duration, is considered. (auth)

34321 USAEC/BMFT AGREEMENT: COOPERATION IN THE FIELD OF REACTOR SAFETY RESEARCH. IRS Kurz-Inform., Reihe D.; No. 7, 1-3(May 1974). (In German).

The principle aims of the cooperation agreement are briefly discussed. (GE)

34322 INVESTIGATIONS IN THE PS-CONTAINMENT OF THE MARVIKEN REACTOR. Appelt, K. D.; Kadlec, J.; Wolf, E. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Reaktorentwicklung). Energie; 26: No. 5, 179-180(May 1974). (In German).

1 fig.; 1 ref.

Blowdown experiments with simulated ruptures in the steam and water piping are performed in the Marviken reactor in order to study the transmission of the transients in mass flow, pressure, and temperature through various sections of the safety containment, and the verification of several mathematical models. (GE)

34323 QUALITY ASSURANCE REQUIREMENTS FOR THE DESIGN OF NUCLEAR POWER PLANTS. New York; American Society of Mechanical Engineers (1974). 19p. (ANSI-N-45.2.11-1974; ICONS-01819).

A standard is presented which lists requirements and provides guidance for a quality assurance program covering activities which affect the final design of nuclear power plant structures, systems, and components whose satisfactory and reliable performance is required: (1) to prevent accidents that could cause undue risks to the health and safety of the public, or (2) to mitigate the consequences of such accidents if they were to occur. (DG)

34324 IEEE STANDARD METHOD FOR IDENTIFICATION OF DOCUMENTS RELATED TO CLASS 1E EQUIPMENT AND SYSTEMS FOR NUCLEAR POWER GENERATING STATIONS. New York; Institute of Electrical and Electronics Engineers, Inc. (1974). 11p. (IEEE-Std-494-1974; ICONS-01821).

Criteria are presented for the uniform identification of documents significant to design, construction, testing, operation, and maintenance of the electric equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, containment and reactor heat removal, or any other system to prevent release of radioactive material to the environment. (HDR)

34325 SAFETY PROBLEMS IN NUCLEAR POWER PLANTS. Bukrinskij, A. M. (Vsesoyuznyj Nauchno-Issledovatel'skij Teplotekhnicheskij Inst., Moscow (USSR)). Arch. Energiewirt.; 28: No. 11, 559-564(Jun 1974). (In German).

3 refs. Also issued in Russian in Teploehnergetika (1974) v. 21(2) p. 8-10.

Report on the operation experience gained with the first units of the nuclear power plants Beloyarsk and Novo-Voronezh is presented. No contamination of the environment has occurred. The amount of fission products released into the environment (xenon, krypton, iodine-131) is comparable to the natural radiation level. (GE)

34326 PROTECTIVE MEASURES AGAINST EXTERNAL EFFECTS AT NUCLEAR POWER STATIONS. Schnurer, H. (Bundesministerium des Innern, Bonn (F.R. Germany)). VGB Kraftwerkstechnik; 54: No. 6, 398-405(Jun 1974). (In German).

From VGB 1973 conference on civil engineering in thermal power plants; Duesseldorf, F.R. Germany (25 Sep 1973). Also published as AED-CONF-73-660-001.

In special circumstances in the densely populated Federal Republic the authorities require special protective measures against the following external effects: chemical explosions in the vicinity of the power station, aircraft crash, earthquakes, the actions of third parties. The following protective measures are taken into consideration: redundant layout of important systems, local separation of redundant systems, intended protection of important systems (such as bunkering and making accessibility difficult). (auth)

34327 DESIGN OF A ONCE-THROUGH COOLING SYSTEM TO MEET THE CHALLENGE OF STRICT THERMAL CRITERIA. Cordaro, M. C. (Long Island Lighting Co., New York); Matchett, D. L. J. Environ. Syst.; 2: No. 3, 207-223(Sep 1972).

A unique approach which combined mathematical analysis, field investigation, and hydraulic model studies was used to generate the data necessary for the design of the once-through discharge system for the Shorham Nuclear Power Station. A multiport diffuser with 65 submerged outlets which discharge horizontally along a 3,800 ft line perpendicular to the principal current direction, starting about 1,600 ft offshore, was developed to satisfy the coastal waters thermal criteria for New York State. Dye studies were used to determine far-field heat return to the discharge area resulting from reversing tidal currents. Hydraulic model studies provided essential information in the dilution capability of a diffuser system in shallow water and under the influence of transient currents. The model studies also defined the near-field temperature buildup at the time of tidal current reversal. (Pollut. Abstr.)

34328 SAFETY RELIES ON RELIABILITY. Poulter, D. R. (United Kingdom Atomic Energy Authority, Risley, Eng.). Engineering; 214: No. 8, 632-636(Aug 1974).

How a designer can assess the risks of failure to equipment or plant in service is described. It is argued that if a suitable design criterion is available probability analysis can be used to determine whether the design meets acceptable safety standards. An illustration of the use of such reliability techniques is given in relation to shutdown systems for an early design of a commercial steam generating heavy water reactor considering the possibilities of loss of electrical supply and of coolant failure. (UK)

34329 PLANT DESIGN AGAINST MISSILES. Hinsdale, IL; American Nuclear Society (1974). vp. (ANS-N-177-1974; ICONS-01813). $12.00.

A standard is presented whose purpose is to: (a) establish consistent ground rules to stabilize the safety evaluation process for establishing adequate protection of nuclear power plants against missiles, (b) provide guidance to systematically design for the protection against missiles required by the AEC's General Design Criterion No. 4 (protection against dynamic effects), (c) guide the designer in determining the sufficiency of design alternatives, and (d) present a simplified set of explanations and requirements maintained in succinct form by referencing (only) carefully selected treatises to cover specialized techniques and sample calculations. (DG)

34330 DESIGN BASIS FOR PROTECTION OF NUCLEAR POWER PLANTS AGAINST EFFECTS OF POSTULATED PIPE RUPTURE. Hinsdale, IL; American Nuclear Society (1974). 24p. (ANSI-N-176-1974; ICONS-01809). $8.00.

A standard is presented which provides a design basis for the protection of nuclear power plant structures and equipment vital for public health and safety from the potential adverse effects of pipe whip, jet impingement, pressurization of compartments, steam environment, and flooding associated with a postulated pipe rupture. The standard is applicable to all light water reactor piping systems, both inside and outside of containment. (DG)

34331 EARTHQUAKE INSTRUMENTATION CRITERIA FOR NUCLEAR POWER PLANTS. Hinsdale, IL; American Nuclear Society (1974). 14p. (ANSI-N-18.5-1974; ICONS-01599).

A standard is presented whose purpose is to define the minimum requirements for an earthquake instrumentation system to be installed at nuclear power plants in order to provide information on the input vibratory ground motion and resultant vibratory response of representative Category I (formerly seismic Class I) structures, equipment, and piping should an earthquake occur. By comparing

this information with the vibratory motions used in the seismic design of the facility, an evaluation can be made as to whether or not the design vibratory motions have been exceeded. (DG)

34332 SITING CONSIDERATIONS FOR OFFSHORE NUCLEAR POWER PLANTS. Seminar Proceedings, New Orleans, Louisiana, April 19, 1974. Park Ridge, IL; Dames and Moore (1974). vp. (CONF-740467-).

Information on the offshore siting of nuclear power plants is presented concerning methodologies for selection of offshore power plant sites; siting, design, and licensing considerations for the Atlantic Generating Station; legal ramifications of offshore nuclear power plant licensing; site investigations for an offshore nuclear power plant; rock borrow investigations for breakwaters to protect offshore nuclear power plants; thermal plume analysis with numerical prediction of turbulent flow and heat transfer in the environment; breakwater for Atlantic Generating Station; and design basis surge and wave action flooding at offshore nuclear power reactor sites. (DCC)

34333 SAFETY OF NUCLEAR REACTOR PLANTS. II. Uchida, H. (Tokyo Univ.). Karyoku Genshiryoku Hatsuden; 24: No. 8, 841-854(Aug 1973). (In Japanese).

Concerning the siting of nuclear power plants in connection with the safety to surrounding populace, the following are described: safety in the siting of nuclear power stations; safety measures in the normal operation of nuclear power plants; the evaluation of siting in presumable accidents; method for the siting evaluation in overseas countries; and trends in the siting evaluation and the problems. Among site conditions, nuclear safety, i.e. the aspect of presumable accidents, emerges as the most prominent. For normal operation, the respective areas of radiation control are most prominent. In Japan, the two types of presumable accidents, i.e. technically conceivable and beyond this possibility, are treated in the site evaluation. As for overseas practices, those in the U. S., Canada, the U. K., and Germany are explained. The recent trends in site evaluation are to emphasize the consequences in normal operation, such as man-rem problem, thermal effluents, and environment. (JA)

34334 LAW ON ALTERATION OF THE ATOMIC RESPONSIBILITY LAW (1968:45). Sv. Forfattningssamling; No. 249, 1-9 (29 May 1974). (In Swedish).

Swedish law spells out the legal responsibility of the possessor of atomic plants or fissionable materials in case of an accident. The law also specifies who pays the indemnity for injuries. (SW)

Reactor Theory and Calculation

Refer also to abstracts 33775, 33778, 33788, 33875, and 34394.

34335 (IFA-FR-120-1974) KINETICS THEORY OF A REFLECTED COUPLED-CORE REACTOR. Lazarescu, Gh. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 17p. Dep. NTIS (US Sales Only) $4.00.

A system of coupled cores is considered, and the kinetics equations obtained under various assumptions concerning such conditions as degree of coupling, boundary conditions, neutron reflection, space-time separability, and symmetry are discussed. (DG)

34336 (IKE-6-85) NEUTRON STREAMING ALONG COOLANT DUCTS. Amin, E. H. A. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Jul 1973. 140p. (In German). INIS.

39 figs.; with tabs.; 48 refs. With abstract. Available from ZAED.

The neutron streaming along real coolant ducts of PWRs, BWRs, and fast breeders has been determined. In calculating this, the transport theory in S_N approximation and a combination of S_N method and collision theory have been used. The problem of determining an optimum set of group data in multigroup form and condensed form has been carefully studied. The results for a sodium coolant pipe are compared with those of different group and point Monte Carlo and diffusion programs with and without transport correction, and differences are discussed. The scope of simple formulas for evaluating the radiation transmission along cylindrical hollow cavities is tested. For small piping diameters the radiation transmission as a disturbance can be well approximated using the program DUCT (comparisons with exact DOT calculations). For a pipe length of 1.2 m, the values of the fast neutron fluxes behave for diameters of 80 cm, 20 cm, and 10 cm as 28:2:1.5. Measures for reduction of the large neutron streaming in the insulation layer of the coolant pipes are proposed. There is a considerable difference of the neutron streaming in sodium and water-cooled reactors. For a pipe length of 1.2 m, the value of the fast neutron flux is one order of magnitude higher than in the water pipe. (GE)

34337 (INDC(CCP)-39/U) NUCLEAR CONSTANTS NO. 8. Providing Nuclear Data for Fast Reactor Calculations. Part 2. 1972. Translation of Russian report. 128p. Dep. NTIS (US Sales Only) $9.50.

Separate abstracts were prepared for both of the papers in this report. (RWR)

For abstracts of individual papers see: 33773 and 33864.

34338 (JAERI-M-5492) PRODUCTION OF FP GROUP CONSTANTS FOR FAST REACTORS WITH COOK'S EVALUATED DATA. Kikuchi, Y.; Tasaka, K.; Nishimura, H.; Hasegawa, A.; Katsuragi, S. (Japan Atomic Energy Research Inst., Tokyo). Dec 1973. 71p. NTIS (US Sales Only).

A set of group constants of 184 FP nuclides was produced with the evaluated data by Cook. They are lumped to those of a pseudo FP nuclide at various burn-up stages, with using the concentrations as weights. The concentrations were calculated by solving the beta chain equations with the yield data compiled by Meek and Rider. Some anomalous behaviors were observed at the resonance energy region and the method for evaluating the resonance structure is briefly discussed. (auth)

34339 (KFK-1931) STATUS AND REQUIREMENTS OF THE PREDICTION OF PHYSICAL PARAMETERS FOR THERMAL AND FAST POWER REACTORS. P. 2. Reactor Dynamics. Schultheiss, G. F. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung). Jan 1974. 272p. (In German). (AED-CONF-74-006-000). INIS.

From experts meeting of the task groups thermodynamics and fluid dynamics and reactor physics of the KTG on requirements and present possibilities of predicting physics parameters of thermal and fast power reactors; Karlsruhe, F. R. Germany (29 Jan 1974).

With figs.; tabs. and refs. With abstract in German and English.

Papers presented to the 2nd Topical Meeting on Reactor Dynamics held by the Reactor Physics and the Thermo-Fluiddynamics Division of the Kerntechnische Gesellschaft im Deutschen Atomforum e.V. in January 1974 are included. The objective of the meeting was to assess the required accuracy and the present status of the predictions of physics parameters for nuclear power reactors. Problems of reactor dynamics for light-water reactors as well as sodium-cooled and gas-cooled reactors are treated. (auth)

34340 (PTB-FMRB-53) DETERMINATION OF THE U-235 BURN-UP BY MEANS OF REACTIVITY MEASUREMENTS IN THE FMRB. Hollnagel, R. (Physikalisch-Technische Bundesanstalt, Berlin (F. R. Germany)). Jul 1974. 16p. (In German). INIS.

13 refs. With abstract in English and German.

The ^{235}U burnup of four MTR-fuel elements was determined by reactivity measurement in the core of the "Research and Measuring Reactor Braunschweig" (FMRB). To convert the reactivity changes into nuclear fuel burnup, the reactivity changes by cadmium absorbers were determined. The conversion of reactivity differences to burnup turned out to be of considerable uncertainty. To improve the situation the reactivity change brought about by a known mass of ^{235}U-fuel should be measured. (auth)

34341 (RD/B/N-3032) APPROXIMATE SOLUTION OF THE MULTIGROUP NEUTRON DIFFUSION EQUATIONS BY SYNTHESIS METHODS. Howarth, N. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). May 1974. 45p. (RPC/RPNK/P-(74)25). Dep. NTIS (US Sales Only) $5.25.

The time-dependent situation where the trial functions are constant over a region of the reactor and are combined by space dependent coefficients (which become the unknowns in the problem) is investigated. Numerical results are presented for a series of synthesis calculations using 2 and 3 trial functions to approximate a one-dimensional 32 energy group calculation. Computing costs are similar to 2 or 3 energy group calculations; indeed the conventional few-group equations can be realized as a particular form of the synthesis approximation. (UK)

34342 (RT-2-1974) SUMMARY OF OPERATIVE CALCULATION CODES IN 1973. Pavelescu, M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 9p. Dep. NTIS (US Sales Only) $4.00.

The following computer codes (Fortran for IBM-370) are summarized: (1) GAME-optimization of reactor operation through application of game theory, (2) STL5 and STL6-criticality calculations in one and two dimensions, (3) BONDAR-solution of time independent multigroup equations for multizone fast reactor, and (4) FEDEVO-calculation of volume fractions and nuclear densities from geometrical dimensions and isotope concentrations. (DG)

34343 (RT/FI-(74)25) IS THE P-M-Z-B-B PROFILE A GENERALIZED POISSON DISTRIBUTION? Pacilio, N.; Jorio, V. M. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). May 1974. 62p. (In Italian). Dep. NTIS (U. S. Sales Only) $6.25.

A direct comparison is presented for profiles of Poisson-Logarithmic, P-M-Z-B-B and Poisson-Radical distributions. A likelihood test is applied upon a wide ensemble of P-M-Z-B-B distributions whose correlation conditions range from very small to very large. There is evidence that the P-M-Z-B-B distribution may well be approximated, in extreme situations, by Poisson-Logarithmic and Poisson-Radical distributions. The structure of the P-M-Z-B-B distribution as "generalized Poisson distribution" is then studied: the Poisson-Logarithmic and the Poisson-Radical profiles belong indeed to that class. (auth)

34344 (RT/ING-(74)14) FLUID REDISTRIBUTION STUDIES IN TWO-CHANNEL TEST SECTIONS. Part I. Theoretical Analysis. Mazzone, G. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Apr 1974. 15p. Dep. NTIS (US Sales Only) $4.00.

Coolant and enthalpy transport equations for two interconnected parallel channels are set up for boiling and non-boiling conditions. For non-boiling conditions analytical solutions are obtained which allow a precise determination of cross-flow and turbulent mixing rates. For boiling conditions a finite difference procedure is indicated. For boiling conditions in one channel and non-boiling in the other, it is shown that mass and energy equations are not sufficient to univocally determine the two channels mass flow rates and enthalpies. Possible solutions of the problem based on different assumptions are indicated. Finally, the experimental conditions under which it is convenient to perform experimental tests are discussed. 4 references. (auth)

34345 FINITE DIFFERENCE APPROXIMATION TO THE TRANSPORT EQUATION IN SPHERICAL SYMMETRY. Kulikowska, T. (Inst. of Nuclear Research, Swierk, Poland). Nukleonika; 19: No. 6, 521-549(1974).

Properties of the solution to the differential part of the transport equation for spherically symmetric systems are investigated. The first order partial derivatives of the solution are shown to exhibit singularities. A condition of disappearance of those singularities is derived. The general formulas for finite-difference operators ensuring the second order approximation uniformly in the whole region are derived and used to investigate numerically the effect of singularities on the errors of numerical solutions obtained by finite-difference methods. 14 references. (auth)

34346 MAXIMIZATION OF K_{eff} IN A HETEROGENEOUS REACTOR BY REDISTRIBUTING FUEL ALONG FUEL ELEMENTS. Artyukhov, G. Ya.; Istomina, I. V.; Makarenkov, Yu. D.; Nevinitsa, A. I.; Pupko, V. Ya.; Raskach, F. P.; Satina, E. P. At. Energ. (USSR); 37: No. 2, 135-138(Aug 1974). (In Russian).

The feasibility of obtaining a maximal value of K_{eff} in a heterogeneous uranium and water reactor by redistributing fuel along fuel elements for a given load has been investigated. The theoretical view that to increase K_{eff} up to a maximal value it is necessary to redistribute the fuel (by changing zone dimensions or fuel density) in accordance with the fuel efficiency function has been confirmed. As a result of optimal arrangement of fuel slugs of three uranium densities at 1.25% increase in K_{eff} over that of a uniform fuel distribution is obtained. 9 references. (auth)

34347 REEXAMINATION OF THE VALUE FOR THE MINIMUM CRITICAL CONCENTRATION OF ^{239}Pu IN WATER. Richey, C. R. (Battelle-Northwest, Richland, WA). Nucl. Sci. Eng.; 55: No. 2, 244-247(Oct 1974).

The limiting critical concentration of ^{239}Pu in aqueous solution has been reevaluated from experimental data obtained in the Physical Constants Test Reactor and determined to be 7.19 ± 0.15 g ^{239}Pu/liter. The value is supported by the results of 18-group diffusion theory calculations of aqueous solutions of both $Pu(NO_3)_4$ and UO_2F_2. (auth)

34348 TRANSPORT CALCULATIONS OF THE NEUTRON ESCAPE PROBABILITY. Melandri, A. M. (Comitato Nazionale Energia Nucleare, Bologna); Premuda, F.; Prelati, G. P. Nucl. Sci. Eng.; 55: No. 2, 225-233(Oct 1974).

Calculations of neutron escape probability from a homogeneous isotropically scattering slab of finite optical thickness are reported as obtained by solving exactly the stationary linear integral transport equation for the total flux of monoenergetic neutrons. This is done for both critical and subcritical configurations of the slab under examination, with both constant and variable sources being referred to in the latter configuration. Due to the transport approach used, the numerical results for the escape probability cover the full range of variation of the mean number of scattered neutrons per collision, c_s, i.e., $0 \leq c_s \leq 1$, whereas the half-thickness of the slab considered ranges from 5 or 10 mean-free-paths down to values as small as 10^{-4} mean-free-paths. (auth)

34349 SPACE-TIME NUCLEAR REACTOR ANALYSIS BY TEMPORAL TRANSFORMATION. Garland, W. J.; Harms, A. A.; Vlachopoulos, J. (McMaster Univ., Hamilton, Ont.). Nucl. Sci. Eng.; 55: No. 2, 119-128(Oct 1974).

The concept of an efficient temporal transformation is introduced in solving stiff space-time equations encountered in nuclear reactor transients analysis. The multigroup diffusion equations are employed for the basic system description. Approximate solutions are found analytically and corrections are made using the alternating direction implicit method to solve the finite difference equations resulting from the transformation. The conditions for stability and convergence of this technique are discussed and the method is illustrated by a two-group two-dimensional analysis of a CANDU-BLW nuclear reactor cell. The method appears particularly appropriate immediately following system perturbations but before the dominant temporal trend has been established. (auth)

34350 A CONTRIBUTION CONCERNING MONTE CARLO METHODS IN REACTOR THEORY. Lieberoth, J. Aachen, Ger.; Technische Hochschule (1972). 183p. (In German). INIS.

19 figs. With abstract. Available from the library of TH Aachen.

The development of the Monte-Carlo method for the solution of neutron transport problems is described, but a comprehensive presentation of all known techniques and theories is not included. The rules of probability theory, the statistical weight, the central limit value rule, pseudo random numbers, the Monte Carlo method as an integration method and simple Monte-Carlo techniques for the treatment of integral operators of interest are presented. (GE)

34351 INVESTIGATION OF THE JOINT EFFECT OF LOCAL AND GLOBAL DRIVING SOURCES IN INCORE-NEUTRON NOISE MEASUREMENTS. Wach, D. (Technische Univ. Muenchen, Garching (F.R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung); Kosaly, G. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Atomkernenergie; 23: No. 4, 244-250(1974).

5 figs.; 23 refs.

The local effect caused by the steam-voids of a boiling water reactor in the noise signals of in-core ion chambers has been proved by measurements and used for practical application in recent times. From the linear phase function of two detectors placed one above the other in the same radial position the mean transit time of the bubbles has been taken and used for the evaluation of the local steam-void velocity. While for the determination of the transit time it is generally assumed that the signals of the adjacent detectors are connected by a simple dead-time-element transfer function, a detailed investigation of the results of Lingen noise measurements showed characteristic deviations from the dead-time behaviour. For the interpretation of the measured transfer functions a simple, but space-dependent theoretical model was developed. In the model the concepts of local and global driving sources of the neutron noise are introduced and their joint effect is investigated. The transfer function derived from the model is compared to the experimental results. The agreement between theoretical predictions and experimental findings supports the validity of the model. Using a 'kinematic method' the fundamental behaviour of the gain and the phase of the cross-power spectral density (and accordingly of the transfer function) is illustratively presented and discussed for different ratios of local and global contributions. (auth)

34352 THEORY OF THE AREA-RATIO METHOD OF SUBCRITICALITY DETERMINATION. Kosaly, G.; Valko, J.; Fischer, A. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Atomkernenergie; 23: No. 4, 251-259(1974).

3 figs.; 4 tabs.; 23 refs.

The validity of Sjoestrand's area-ratio method is investigated. It turns out that the Gozani-method cannot be always considered as a corrected version of Sjoestrand's method. On the contrary, the two methods are independent and in a sense complementary. As regards the validity of Sjoestrand's method two statements are made. Firstly, the applicability of the area-ratio method depends on the shape of the initially introduced neutron pulse which, in turn, depends, besides on source position, on the properties of the reactor. A 'most advantageous source shape' is defined. Secondly, it is suggested that the applicability of the method is largely increased as heavily reflected reactors are considered. (auth)

34353 USE OF THE BACKWARD KOLMOGOROV EQUATION WITH DELAYED NEUTRONS IN COUNTING STATISTICS. Arcipiani, B.; Marseguerra, M. (Comitato Nazionale per l'Energia Nucleare, Bologna (Italy)). Atomkernenergie; No. 4, 231-237(1974).

2 figs.; 6 refs.

Neutron counting statistics in a subcritical nuclear reactor are discussed, explicitly taking into account the delayed neutrons. In the framework of the space and energy independent reactor model, an integro-differential equation for the probability generating

function (pgf) of the number of neutrons detected in fixed time intervals is established. To this end the formalism of the backward Kolmogorov equation is applied. Analytical solutions of the established equation are discussed and shown to be rather impracticable to get probabilities and moments. However, without the explicit knowledge of the pgf, the same goal may be attained making use of an alternative procedure leading to systems of first order differential equations whose integration directly delivers the moments and probability profile. (auth)

34354 A THEORETICAL BASIS OF BUBBLE MOTION IN REACTOR CHANNELS. Techy, Z.; Szabados, L. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Atomkernenergie; 23: No. 4, 225-230(1974).

11 refs.

A theoretical basis of bubble motion in reactor channels is given. A diffusion approach formulated by Houghton and Sha on the analog of Brownian motion is proved by statistical terms of the random motion of steam bubbles and in addition the diffusion coefficient is evaluated. The bubble motion is affected by the flow which itself is not affected by the bubble motion. The bubble size is assumed to be much smaller than the length scale of the turbulent fluctuations. The coefficients of the Fokker-Planck equation for bubble motion are evaluated by use of a phenomenological equation. The diffusion equation derived in this work in statistical terms of the random motion of steam bubbles is expected to describe correctly the mean characteristic features of the process, especially in the case of small-sized bubbles. (auth)

34355 NONITERATIVE METHOD FOR SOLVING THE ADJOINT EQUATIONS OF A CRITICAL REACTOR. Kochurov, B. P. Sov. At. Energy (Engl. Transl.); 35: No. 1, 669-671(Jul 1973).

Translated from At. Energ. (USSR); 35: No. 1, 52-54(Jul 1973).

The use of matrix factorization in solving the adjoint equations in two steps when the greatest eigenvalue of the forward (and adjoint) equation is discussed. It is shown that the solution can be found after one step forward and one step backward. (TSS)

34356 HETEROGENEOUS EFFECTS OF SODIUM AND ^{238}U AND OF CERTAIN CROSS SECTION RATIOS IN A BFS-22. Yurova, L. N.; Bushuev, A. V.; Duvanov, V. M.; Kozhin, A. F.; Sirotkin, A. M. Sov. At. Energy (Engl. Transl.); 35: No. 1, 661-662(Jul 1973).

Translated from At. Energ. (USSR); 35: No. 1, 47-50(Jul 1973). This is a summary of paper No. 673/6761 with full copy held at TIC.

The nature and magnitude of the effects of the heterogeneous arrangement of core materials were investigated by examining the distribution of $^{238}U(n,\gamma)$ and $^{23}Na(n,\gamma)$ reactions in disks of natural uranium and metallic sodium in different zones of a critical assembly, the BFS-22. The experiments are based on the detection of γ-radiation from the reaction products, ^{239}Np and ^{24}Na, which were accumulated during the process of irradiation in the corresponding inserted disks of natural uranium and metallic sodium foil. The distribution of the $^{23}Na(n,\gamma)$ reaction in the volume of the BFS-22 was also investigated through the γ activity of standard sodium disks incorporated into the structure of the installation. Measurements were performed at the center of the BFS-22 for the determination of the reaction cross section ratios, $\sigma_c(^{23}Na)/\sigma_f(^{235}U)$, $\sigma_c(^{238}U)/\sigma_f(^{235}U)$, $\sigma_f(^{238}U)/\sigma_f(^{235}U)$, based on the detection of γ radiation from the corresponding reaction products. Results of measurements and calculations are presented. The results indicate that in some cases during calculation of the neutron field it is necessary to take into account the effects of resonance blocking of the cross sections associated with a heterogeneous arrangement of the materials. (auth)

34357 COMPARISON OF TWO ALGORITHMS FOR THE EMERGENCY SHIELDING OF A REACTOR DURING REACTIVITY DISTURBANCES. Sarkisov, A. A.; Puchkov, V. N. Sov. At. Energy (Engl. Transl.); 35: No. 2, 761-762(Aug 1973).

Translated from At. Energ. (USSR); 35: No. 2, 134-135(Aug 1973).

The difference between the emergency-shielding (ES) algorithms being compared is that, in one, the instantaneous value of the relative reactor power is bounded, while in the other, it is the relative rate of increase in neutron density that is bounded. The emergency modes of a water-cooled nuclear reactor using ^{235}U fuel are studied. Disturbances were introduced by changing the reactivity at certain constant rates. Kinetic equations with six groups of delayed neutrons were used in mathematical description of the process. (auth)

34358 CALCULATION OF FAST REACTORS. An Eigenvalue and Eigenvector Problem. Pavelescu, M. (Institutul de Fizica Atomica, Bucharest). Stud. Cercet. Fiz.; 25: No. 2, 151-166 (1973). (In Rumanian).

The multigroup equations are studied in one dimension using the diffusion approximation in various ways in the difference approximation to calculate eigenvalues and eigenvectors for fast reactors. It is shown that it is possible to use a compact matrix notation for the resulting simultaneous equations to formulate the eigenvalue and eigenvector problem for obtaining the maximum eigenvalue, which is the multiplication factor. (DG)

34359 ANALYTICAL DETERMINATION OF SUBGROUP PARAMETERS. Sinitsa, V. V.; Nikolaev, M. N. Sov. At. Energy (Engl. Transl.); 35: No. 6, 1129-1131(Dec 1973).

Translated from At. Energ. (USSR); 35: No. 6, 429-430(Dec 1973).

A method is presented for calculating neutron resonance fields in heterogeneous systems. The subgroup parameters are determined using an analytic method that ensures conservation of only the most important cross section moments rather than the detailed fine structure. (HDR)

34360 NEUTRON DISTRIBUTION NEAR THE END OF A PARTIALLY IMMERSED COMPENSATING ROD. Koroleva, V. P.; Pashkin, Yu. G.; Chekunov, V. V.; Chernov, L. A. Sov. At. Energy (Engl. Transl.); 35: No. 6, 1141-1142(Dec 1973).

Translated from At. Energ. (USSR); 35: No. 6, 435-436(Dec 1973).

An experiment was conducted to test the validity of a proposed method for calculating the neutron capture density near the end of a partially immersed boron-containing absorber rod. The calculated and measured results show close agreement. (DG)

34361 OPTIMAL DISTRIBUTION OF NUCLEAR FUEL IN A CYLINDRICAL FUEL ELEMENT. Milovanov, Yu. V.; Petrov, E. E.; Pupko, V. Ya. Sov. At. Energy (Engl. Transl.); 35: No. 6, 1121-1122(Dec 1973).

Translated from At. Energ. (USSR); 35: No. 6, 423-425(Dec 1973). This is a summary of paper No. 705/7163 with full copy held at TIC.

In order to minimize the radial temperature gradient in the fuel element, the optimal distribution of nuclear fuel over the radius of the element is found for various ratios of fuel thermal conductivity to matrix thermal conductivity. (DG)

34362 EFFECTIVE RESONANCE INTEGRAL FOR A WIDELY SPACED LATTICE AND FAST-NEUTRON MULTIPLICATION. Bu. mistrov, A. Ya.; Kochurov, B. P. Sov. At. Energy (Engl. Transl.); 35: No. 2, 744-745(Aug 1973).

Translated from At. Energ. (USSR); 35: No. 2, 122-123(Aug 1973). This is a summary of paper No. 679/6979 with full copy held at TIC.

The fast fission factor ϵ for a 0.8 MeV fission threshold and the correction to the resonance integral ΔRI in the 10 keV to 0.8 MeV range were calculated by a program based on the solution of a multigroup system of Peierls integral equations in a multizone cylindrical cell. Assuming identical spatial and energy distributions of sources due to fast and thermal neutron fissions, the solution is obtained by a single calculation with subsequent source renormalization. The error introduced by this assumption can be removed by an iterated calculation. The fast fission factor ϵ and the resonance escape probability φ in the 10 keV to 0.8 MeV energy range are written as bilinear functionals of the neutron flux. The effect of the reflection of neutrons from the moderator into a slug is more important for graphite than for heavy water because there is a smaller energy loss in scattering in graphite. As the lattice pitch is decreased there are more straight paths of neutrons from slug to slug and ϵ is increased. The increase in ΔRI with cell volume V_c is caused by the increase in the nonuniformity of the neutron distribution over the cell. The value of ΔRI is approximately one third as large for a graphite moderator as for heavy water. Replacing the fission spectrum by the delayed neutron spectrum increases the correction ΔRI by a factor of about 2.5. (auth)

Reactor Components and Accessories

Refer also to abstracts 31972, 32746, 32774, and 34388.

34363 (AED-CONF-74-002-006) EVALUATION OF THERMODYNAMIC ENVIRONMENTAL CONDITIONS FOR SAFETY SYSTEMS IN THE ANNULUS OF A REACTOR SAFETY CONTAINMENT. Brosche, D. 1974. 4p. (In German). INIS.

From second information meeting of the Laboratorium fuer Reaktorregelung und Anlagensicherung Garching (LRA); Muenchen, F. R. Germany (16 Jan 1974).

The performance of the safety systems in the annulus of a reactor safety containment after a loss of coolant accident is analyzed. (INIS)

34364 (ANL-CT-74-06) DESIGN GUIDE FOR CALCULATING NATURAL FREQUENCIES OF STRAIGHT AND CURVED BEAMS ON MULTIPLE SUPPORTS. Chen, S. S.; Wambsganss, M. W. (Argonne National Lab., Ill. (USA)). Jun 1974. Contract W-31-109-eng-38. 53p. Dep. NTIS $5.45.

A graphical method is presented for calculating natural frequencies of straight and curved beams with multiple spans of equal length. The method is simple, and its degree of accuracy is directly related to the accuracy with which frequency factors are read from the graphs. 6 references. (auth)

34365 (ANL-CT-75-03) BOUNDS AND LIMIT THEOREMS FOR SECONDARY CREEP IN SYMMETRIC PRESSURE VESSELS. Edelstein, W. S.; Valentin, R. A. (Argonne National Lab., Ill. (USA)). Aug 1974. Contract W-31-109-eng-38. 29p. Dep. NTIS $4.50.

The field equations governing creep in spherical and incompressible cylindrical pressure vessels subject to a nondecreasing internal pressure are reduced to a single equation in the effective stress. Using this equation, bounds are obtained for the effective stress and the displacement at any point in the body at any time. Also, in the case where the pressure tends to a limit as $t \to \infty$, limit theorems are obtained which describe the long term behavior of the effective stress and the displacement. 7 references. (auth)

34366 (CONF-730465-(P3)) PROCEEDINGS OF INTERNATIONAL SYMPOSIUM ON VIBRATION PROBLEMS IN INDUSTRY, KESWICK, ENGLAND, 10-12 APRIL 1973. Session 3. Weightman, P. (ed.). (UKAEA Reactor Group, Sellafield; National Physical Lab., Teddington (UK)). 1973. 257p. Dep. NTIS (US Sales Only) $16.00.

Twelve papers are presented concerning the response of mechanical structures to vibrations and stresses. (DCC)

34367 (CONF-730465-(P4)) PROCEEDINGS OF INTERNATIONAL SYMPOSIUM ON VIBRATION PROBLEMS IN INDUSTRY, KESWICK, ENGLAND, 10-12 APRIL 1973. Session 4. Weightman, P. (ed.). (UKAEA Reactor Group, Sellafield; National Physical Lab., Teddington (UK)). 1973. 268p. Dep. NTIS (US Sales Only) $16.50.

A separate abstract is included for one of the thirteen papers presented concerning basic fluid dynamics data and heat exchanger problems. Three of the papers have previously been abstracted and included in NSA. These papers can be found under the following abstract numbers in Volume 29 of NSA: 29239; 31198; and 31174. (DCC)

For an abstract of an individual paper see: 34368.

34368 (CONF-730465-(P4), pp vp Paper 422) CALCULATION OF NATURAL FREQUENCIES OF HEAT EXCHANGER TUBES. Elliott, G. L.; Pick, R. J. (Univ. of Waterloo, Ont.). 1973.

From international symposium on vibration problems in industry; Keswick, UK (10 Apr 1973).

To prevent flow induced vibration of heat exchanger tubes it is common to design for natural frequencies well above excitation frequencies. The calculation of natural frequencies of straight and curved tubes with multiple supports can be made using finite element techniques. Examples of the use of this technique are presented. Clearances often exist between tubes and support to allow assembly and fluid flow. Impact of the tube with the support can cause wear if impact loads are high. By numerically integrating the equations of motion derived from the finite element model impact forces and tube behaviour can be predicted. An example of a cantilever beam is used to illustrate the results of this technique. 13 references. (auth)

34369 (CONF-730465-(P6)) PROCEEDINGS OF INTERNATIONAL SYMPOSIUM ON VIBRATION PROBLEMS IN INDUSTRY, KESWICK, ENGLAND, 10-12 April 1973. Session 6. Weightman, P. (ed.). (UKAEA Reactor Group, Sellafield; National Physical Lab., Teddington (UK)). 1973. 235p. Dep. NTIS (US Sales Only) $14.75.

Twelve papers are presented concerning the structural response of reactor components to vibrations. Seven of the papers have been previously abstracted and included in NSA. These papers can be found under the following abstract numbers in Volume 29 of NSA: 31392, 31215, 31376, 31159, 31252, 31185, and 31393. (DCC)

34370 BARRIERS PROVIDING RADIATION SAFETY AT NUCLEAR POWER PLANTS. Anan'ev, E. P.; Kruzhillin, G. N. At. Energ. (USSR); 37: No. 1, 22-27(Jul 1974). (In Russian).

Three barriers promoting radiation safety and reliable operation of nuclear power plants are considered. The major barriers to radiation at nuclear power plants is the fuel element cladding, which in turn is protected from accidental burn-outs by an automatic safety control system providing cooling of the core under normal, shutdown and emergency conditions. The second barrier to the spread of radioactivity is the hermeticity of vessels and pipelines in a reactor plant. Data on the hermeticity of vessels and pipelines during operation in conventional steam power plants are presented. The third barrier impeding the spread of radioactivity consists of protective envelopes (containment vessels) designed to confine the steam released from the entire mass of hot water in the circuit, i.e., for the case of complete rupture of the main circulation pipeline accompanied by the escape of evaporating water from both ends of the pipeline. Containment vessels are discussed as an integral component of primary circuit equipment. A system which does not use containment vessels for radioactivity localization during pipeline rupture and provides for the preservation of the free box arrangement of equipment adopted in the USSR is considered. 7 references. (auth)

34371 TRENDS IN STRUCTURAL MECHANICS. A UK REVIEW OF THE 2nd INTERNATIONAL CONFERENCE ON STRUCTURAL MECHANICS IN REACTOR TECHNOLOGY. II. Structural Analysis of Prestressed Concrete Pressure Vessels. Leckie, F. A. (Univ. of Leicester, Eng.). J. Brit. Nucl. Energy Soc.; 13: No. 3, 285-286(Jul 1974).

Some observations made at the 2nd International Conference on Structural Mechanics in Reactor Technology, Berlin 1973, are discussed. It is concluded that plastic finite element procedures are generally successful, that closer relation between analysis results and design decisions will be possible when data generating techniques improve, and that limit analysis calculations are achieved more economically by using deformation patterns rather than a full elastic/plastic/cracking calculation. It is noted that no mention is made of design using the shake-down concept which is partway between plastic and collapse analysis. Although more complex analyses are possible, confident interpretation of results is still difficult in the absence of suitable design concepts. (UK)

34372 TRENDS IN STRUCTURAL MECHANICS. A UK Review of the 2nd International Conference on Structural Mechanics in Reactor Technology. III. Containment Design: Dynamic Aspects of Loading. Davies, I. L. (Taylor Woodrow Construction Ltd., Southall, Eng.). J. Brit. Nucl. Energy Soc.; 13: No. 3, 287-288(Jul 1974).

A review of some of the papers on containment design presented at the 2nd International Conference on Structural Mechanics in Reactor Technology in Berlin, 1973, reveals a significant move toward consideration of the loading transients that may develop and a study of the dynamic response of containment structures. The loading situation for loss-of-coolant accident is discussed, with particular reference to the failure of a relief valve at Wurgassen in April 1972. The effects of impacting missiles such as aircraft and also loadings generated by gas pressure waves associated with detonation of TNT were the other topics highlighted. (UK)

34373 TRENDS IN STRUCTURAL MECHANICS. A UK Review of the 2nd International Conference on Structural Mechanics in Reactor Technology. IV. Application of Fracture Mechanics. O'Neil, R. (United Kingdom Atomic Energy Authority, Culcheth, Eng.). J. Brit. Nucl. Energy Soc.; 13: No. 3, 289-293(Jul 1974).

The practical application of fracture mechanics is discussed in the light of papers presented at the 2nd International Conference on Structural Mechanics in Reactor Technology, Berlin, 1973. After briefly considering the problem of the estimation of critical crack, in relation to small defects in reactor pressure vessels, several of the Berlin papers dealing with linear elastic fracture mechanics, or its derivatives, are examined for a solution to the problem. It is concluded that there is little to choose between the numerous methods of calculating critical crack size. However no completely satisfactory crack arrest philosophy has yet been presented. There is also a growing acceptance of the need to improve linear elastic fracture mechanics, probably by use of COD or J integral method. (UK)

34374 TRENDS IN STRUCTURAL MECHANICS. A UK Review of the 2nd International Conference on Structural Mechanics in Reactor Technology. IX. Pipework Systems. Jobson, D. A. (United Kingdom Atomic Energy Authority, Risley, Eng.). J. Brit. Nucl. Energy Soc.; 13: No. 3, 321-324(Jul 1974).

Some of the papers on nuclear pipework presented at the 2nd International Conference on Structural Mechanics in Reactor Technology, Berlin, 1973, are reviewed. The survey concentrates on papers which, in addition to their technical content, raise wider issues, e.g., the codes recently introduced in the USA on nuclear pipework, the extent to which load predictions may need modifying to allow for elasto-plastic instabilities, and the possible consequences of repeated thermal shock when considering sodium-cooled reactor development. (UK)

34375 TRENDS IN STRUCTURAL MECHANICS. A UK Review of the 2nd International Conference on Structural Mechanics

in Reactor Technology. X. Finite Elements. Stoker, J. R. (General Electric Co. Ltd., Wembley, Eng.). J. Brit. Nucl. Energy Soc.; 13: No. 3, 324-330(Jul 1974).

Those papers presented at the 2nd International Conference on Structural Mechanics in Reactor Technology, Berlin, 1973, which were concerned with finite element analysis are summarized, together with brief comments. (UK)

34376 TRENDS IN STRUCTURAL MECHANICS. A UK Review of the 2nd International Conference on Structural Mechanics in Reactor Technology. XI. Heat Conditions. Stoker, J. R. (General Electric Co. Ltd., Wembley, Eng.). J. Brit. Nucl. Energy Soc.; 13: No. 3, 330-331(Jul 1974).

A brief indication is given of the contents of the five papers presented at the session on heat conduction analysis at the 2nd International Conference on Structural Mechanics in Reactor Technology, Berlin, 1973. Four of the papers were concerned with analytic methods, and one with the finite element method. (UK)

34377 TRENDS IN STRUCTURAL MECHANICS. A UK Review of the 2nd International Conference on Structural Mechanics in Reactor Technology. XII. Structural Analysis of Heat Exchangers. Fullard, K. (Central Electricity Generating Board. Berkeley, Eng.). J. Brit. Nucl. Energy Soc.; 13: No. 3, 331-332 (Jul 1974).

Some of the activities of interest to nuclear engineers, on structural analysis of heat exchangers, which were discussed at the 2nd International Conference on Structural Mechanics in Reactor Technology, Berlin, 1973, are high-lighted. The components considered were tubes and perforated plates. Questions of design and integrity were discussed and developments in the field of finite element thermal analysis schemes described. (UK)

34378 CORRELATIONS OF NEUTRON EMBRITTLEMENT WITH COMPOSITION AND DAMAGE FLUENCE OBSERVED FROM POWER REACTOR PRESSURE VESSEL SURVEILLANCE PROGRAMS. Serpan, C. Z. Jr.; Hawthorne, J. R. (Naval Research Lab., Washington, DC). pp 365-377 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

Primary correlations concerning radiation embrittlement of steel, evolved from test reactor research, are critically assessed and verified with recent results from power reactor surveillance programs. Neutron embrittlement, taken as the increase in brittle/ductile transition temperature, was indexed from Charpy-V 30 ft-lb (4.2 kg) behavior. This study verifies that increasing copper content exerts an increasingly detrimental effect upon the radiation resistance of steel as observed from a number of different A302-B plates and weld deposits and A336 forgings and weld deposits of power reactors. Detrimental effects of residual (impurity) phosphorus content and of alloying nickel content are also suggested by the data. Additional comparisons show that power and test reactor data can be very successfully correlated using neutron spectra and damage cross sections from damage functions, G(E), when combined as a neutron damage fluence for $n/cm^2 \times G(E) > 0.1$ MeV. The studies show that several steels exhibit continuing embrittlement above neutron damage fluences of about 2×10^{20} $n/cm^2 \times G(E) > 0.1$ MeV, rather than the previously anticipated saturation of radiation damage. The studies show that knowledge of steel composition, neutron spectra and neutron damaging capacity are essential for close estimation of radiation embrittlement trends and best optimization of reactor operating parameters. (auth)

34379 STATE OF DEVELOPMENT OF STEELS WITH HIGH WELDABILITY USED FOR HEAT-AFFECTED PRESSURE VESSELS IN STEAM POWER AND NUCLEAR POWER PLANTS. von Reumont, G. A. (Rheinstahl Huettenwerk A.G., Hattingen (F.R. Germany). Heinrichshuette). VGB Kraftwerkstechnik; 54: No. 6, 418-430(Jun 1974). (In German).

From VGB conference: Materials and welding techniques in power plants; Duesseldorf, F.R. Germany (27 Nov 1973). 32 figs.; 4 tabs.; 51 refs.

The requirements to be fulfilled by steels used for the construction of thick-walled, heat-affected pressure vessels such as boiler drums or reactor pressure vessels are specified and discussed. The development of a particular steel is described where these requirements have been taken into account. (GE)

34380 EQUIPMENT FOR CONTROL OF WATER REGIME IN REACTOR. Zajic, V. (Inst. of Nuclear Research, Rez, Czech.). Nukleon; No. 2-3, 21-27(1973). (In Czech).

The principles are described of and experience is presented with high-pressure sensing devices developed at the Nuclear Research Institute. The devices are designed for continuous monitoring of electric conductivity, pH value, radiolysis product concentration, and instantaneous corrosion rate of structural materials necessary during investigations of the water regime in nuclear installations exposed to radiation. A large-scale use of the devices not limited to the field of nuclear engineering is recommended in view of a relative feasibility of their manufacture, an easy maintenance and calibration, a simple installation, and favorable experience regarding the service life of the devices. (Nucl. Sci. Abstr. Czech.)

34381 MACHINERY AND EQUIPMENT FOR NUCLEAR POWER GENERATION. Arii, M.; Hoshikawa, S. (Tokyo Shibaura Electric Co. Ltd., Kawasaki, Japan). Yosetsu Gijutsu; 21: No. 9, 49-52(Sep 1973). (In Japanese).

Nuclear power generation is becoming increasingly important with one after another power plant being put in operation. These are currently BWR's and PWR's moderated with light water, and for the future, FBR's with Na coolant. Regarding the machinery and other equipment for such nuclear power plants, welding aspects are extremely important. The following are described in this respect: the quality of structural materials; dimensional accuracy requirements, stringent quality control; and field assemblage. The material mainly used is austenitic stainless steel and inconel. Peculiar in this field is the process of machining first, then followed by welding. (JA)

34382 SPECIFICATIONS FOR PRESSURE VESSELS, 1973. Specifications for Strength Calculations of Pressure Vessels. Stockholm; Tryckkaerlskommissionen (1973). 375p. (In Swedish).

Swedish specifications are given for strength calculations of pressure vessels, which through explosion, rupture, compression, or leakage may cause accidents. Various steels, iron, and aluminium are treated. Specifications are given for pressure vessels of different shapes. Vacuum equipment and pressure tubes are included. Formulas for calculation are given. (SW)

34383 METHODS FOR THE ACCUMULATION AND TRANSMISSION OF SIGNALS FROM IN-CORE INSTRUMENTS WITHOUT PENETRATION OF THE REACTOR VESSEL. Sangiovanni, G. (Univ., Rome). Ing. Nucl.; 14: No. 4, 10-18(1973). (In Italian).

Studies were initiated to determine methods for the accumulation and transmission of data from within the reactor vessel to the outside without penetration of the vessel. The functions which such a device should have were tabulated. The advantages and disadvantages of ultrasonics, optical coupling, and radiofrequency were discussed. A radiofrequency device was constructed and tested. The results showed the practicality of the principle and the validity of this method of accumulation and transmission of data. It has not been developed to the point of practical application. (JSR)

Reactor Fuels

Refer also to abstracts 31475, 31500–31502, 31712, 31713, 31716, 31717, 31720, 32667, 32738, and 32767.

34384 (BNWL-tr-128) INCREASING THE CENTRAL TEMPERATURE BY URANIUM–PLUTONIUM REDISTRIBUTION IN MIXED OXIDE FUEL RODS OF FAST REACTORS. Bober, M.; Schumacher, G. (Kernforschungszentrum Karlsruhe (F.R. Germany)). Apr 1974. Translation of KFK-1904. 38p. Dep. NTIS $5.00.

Results of post irradiation examinations of redistribution of uranium and plutonium in fast reactor mixed oxide fuel pins are reviewed. Redistribution by evaporation-condensation processes clearly depends on stoichiometry and only to a less degree on power rating and burnup. It mainly develops in the first stage of fuel restructuring. At the central void the plutonium enrichment yields up to 170% of the average concentration. This causes an increase in central temperature up to 150°C. The enrichment due to redistribution by thermal diffusion is mainly determined by power rating and burnup. It still grows until the irradiation has been finished. At a power rating of 500 W/cm the enrichment of plutonium yields up to 140% which increases the central temperature up to 100°C. 31 references. (auth)

34385 (IFA-TR-59-1974) DETERMINATION OF THE COEFFICIENT OF UNCERTAINTY BY THE STANDARD DEVIATION METHOD FOR THE TEMPERATURES OF THE WALL OF FUEL ELEMENTS. Dzheordzhescu, R. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 19p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The use of the standard deviation method for the determination of the coefficients of uncertainty in the wall temperatures of fuel elements is examined, and the basic principles of the

method are outlined. The results obtained with the standard deviation method are compared with those obtained by the multiplication method. The results of the standard deviation method would permit the increase of the inlet temperature of the liquid into the core by 30 to 40%. (JSR)

34386 (KFK-1831) INVESTIGATIONS ON THE REACTION BEHAVIOUR OF STEELS WITH SIMULATED FISSION PRODUCTS IN THE PRESENCE OF UO_2, $(U,Pu)O_2$, AND UC AND POSSIBILITIES TO IMPROVE THE COMPATIBILITY BEHAVIOUR OF OXIDE FUEL PINS. Hofmann, P. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter; Karlsruhe Univ. (TH) (F. R. Germany). Fakultaet fuer Maschinenbau). Mar 1974. 116p. (In German). INIS.

219 figs.; 27 tabs.; 55 refs. With abstract in German and English.

The reaction behavior of uranium oxide, uranium plutonium mixed oxide and uranium carbide with and without the addition of simulated fission products with regard to austenitic stainless steels was investigated. First, an assessment of the compatibility conditions in the various cladding material-fuel-fission product systems was made using the available thermodynamic data. Out-of-pile compatibility tests were performed with the thermodynamically instable sytems. The test temperatures varied between 200 and 1,000°C, the annealing periods between 10 and 3,000 h. The simulated burnup was 10 and 20 at. %. As cladding materials, the austenitic steels 1.4401, 1.4541, 1.4970, 1.4981 and 1.4988 were tested. (auth)

34387 EXPERIMENTAL STUDY OF HEAT EXCHANGE FOR TURBULENT FLOW OF WATER IN A CLOSELY PACKED TRIANGULAR BUNDLE OF RODS. Bobkov, V. P.; Ibragimov, M. Kh.; Sinyavskii, V. F.; Tychinskii, N. A. At. Energ. (USSR); 37: No. 2, 127-130(Aug 1974). (In Russian).

The results are presented of an experimental study of temperature fields in the wall and stream of water: ($p_r \approx 5$) at $Re = 2 \cdot 10^3 + 6 \cdot 10^4$ for flow in a channel formed by close packing of cylindrical rods. The effect of heat flow on temperature field and average heat transfer coefficients was investigated. 8 references. (auth)

34388 TRENDS IN STRUCTURAL MECHANICS. A UK Review of the 2nd International Conference on Structural Mechanics in Reactor Technology. XIII. Vibration Analysis. Jobson, D. A. (United Kingdom Atomic Energy Authority, Risley, Eng.). J. Brit. Nucl. Energy Soc.; 13: No. 3, 333-337(Jul 1974).

Papers presented at the 2nd International Conference on Structural Mechanics in Reactor Technology, Berlin, 1973, which were devoted to vibration aspects are reviewed. They were concerned mainly with flow-induced movement of fuel rods and bundles and vibration of reactor components. The scope of the papers shows that current trends are leading toward statistical descriptions and probabilistic assessments. (UK)

34389 SUPPLY, DEMAND, AND PROCUREMENT OF NUCLEAR FUEL. Fujii, H.; Hashimoto, T. (Federation of Electric Power Companies, Tokyo). Karyoku Genshiryoku Hatsuden; 24: No. 5, 516-521(May 1973). (In Japanese).

The nuclear fuel cycle comprises uranium-ore mining and concentration, conversion to uranium hexafluoride, enrichment, fuel fabrication, charging fuel in reactors, and reprocessing. In Japan, approximately 14,000 short tons U_3O_8 per year is expected to be necessary in 1985; the cumulative amount from 1970 to that year will then reach about 108,000 st U_3O_8. It is a large problem securing such a quantity in stabilized supply and at low cost. In this connection, the following are explained: world supply-demand situation, including uranium reserve, annual production capability, and development of resources; the situation in Japan, including development of nuclear fuel resources and the measures for the procurement of uranium; and efficient fuel usage and thorium resources. (JA)

Reactor Control Systems

34390 (EUR-5036) ON-LOAD SURVEILLANCE OF NUCLEAR POWER PLANT COMPONENTS BY NOISE AND VIBRATION ANALYSIS. (Commission of the European Communities, Luxembourg). May 1974. 274p. Dep. NTIS (U. S. Sales Only) $16.75. B. Fr. 300.

The state of the art in on-load surveillance techniques, based on noise and vibration analysis, for light-water reactor components and turbines is presented. The theoretical principles, the measuring devices and procedures of the various techniques are reviewed. A summary is given of the experimental results obtained, so far, by the different organizations involved in the preparation of the report. A comparative analysis of the experimental results is presented. (auth)

34391 (FRNC-CONF-106) OPERATING CONTROL OF LIGHT WATER NUCLEAR PLANTS. Hermant, C. (Electricite de France, 92 – Courbevoie. Service Etudes et Projets Thermiques et Nucleaires). 1973. 13p. (In French). (CONF-730983-6). Dep. NTIS (U. S. Sales Only) $4.00.

From congress of the Society of Electrical, Electronic and Radio Engineers meeting; Vittel, France (11 Sep 1973).

After recalling the problem posed by the definition of operating control, the report sets forth the principles of the system envisaged for the light water nuclear installations presently under study in France. The main functions are analyzed so as clearly to bring out the respective roles of automatic control and human control in commissioning, operating and supervising an installation. (FR)

34392 SHOCK DYNAMICS OF NUCLEAR REACTOR STRUCTURE. Suzuki, S. (Nagoya Univ., Japan). Kikai No Kenkyu; 26: No. 2, 251-256(Feb 1974). (In Japanese).

When the power of nuclear reactors increases abnormally, control rods must be dropped down and inserted into the reactor core. When the control rods strike at the upper end plate of the reactor core, extremely high shock stress is induced at side structure as well as grid plates. The dynamic behavior of the side structure was analyzed, assuming that the side structure is an elastic thin cylinder. Since the cylinder is restricted by the grid plate in radial direction in some degree, this restriction was represented by distributed springs. The maximum value of circumferential stress loaded with shock load is extremely larger than that with static load. Relatively high shock stress appears at the places where stress is almost zero under static load. This result is a noticeable fact. The dynamic behavior of a control rod at the moment of collision was analyzed by using a model that a rod with constant velocity collides with a spring, one end of which is fixed on a rigid body. The maximum value of longitudinal stress was very large, but decreased rapidly with the decrease of spring constant. The rate of decrease of the maximum value is large when the ratio of diameter to length of the cylindrical rod is large. (JA)

34393 AUTOMATIC CONTROL EQUIPMENT OF THE TR-O REACTOR. Frystacky, J.; Kult, L. Nukleon; No. 4, 6-11(1973). (In Czech).

Information is presented on the automatic control equipment of the TR-O reactor. This equipment secures attaining and stabilization of the criticality, power control by a cadmium rod or by D_2O level, continuous monitoring of the equipment, warning and accident signals. Furthermore, information is given on a coarse and fine level meter and on the process computer ESTIMATOR, which is used for the mapping of the reactor neutron flux. 7 references. (auth)

34394 MONTE CARLO CALCULATIONS FOR ASSESSMENT OF THE REACTIVITY WORTH OF MOVABLE REFLECTOR SEGMENTS IN COMPACT REACTORS. Bernnat, W. Stuttgart, Ger.; Stuttgart Univ. (1972). 72p. (In German). INIS.

Thesis. With figs., and refs. With abstract. Available from the library of Stuttgart Univ.

The calculation of reactivity changes due to the movement of reflector segments is difficult in compact reactors because of the pronnounced neutron leakage from the small core and because of streaming effects. These problems can be treated by three-dimensional Monte-Carlo methods or under simplified assumptions with $S_{(N)}$ of diffusion programs and hohlraum-boundary conditions. The reactivity changes due to reflector moving are often so small that independent Monte-Carlo simulations, even when using weighting functions, require unacceptable long computing times. For this reason, a modified Monte-Carlo method with correlated simulation of neutron paths was developed in order to same computing time. To test the method two experiments in the critical assembly of the Incore Thermionic Reactor were recalculated and compared with the corresponding measured values. (GE)

34395 ENGINEERING PROBLEMS OF CONTROLLING UNSTABLE POWER DISTRIBUTION IN A NUCLEAR REACTOR. Emel'yanov, I. Ya.; Filipchuk, E. V.; Potapenko, P. T.; Neboyan, V. T. At. Energ. (USSR); 37: No. 2, 118-122(Aug 1974). (In Russian).

Technical problems in constructing a system of automatic control of unstable power distribution in a reactor are analyzed. A positive coefficient of reactivity results in instability. Control and regulation is achieved by dividing the reactor core into several cells, each having a neutron flux detector. These cells contain equal numbers of rods moving synchronously during operation. The mathematical model of the reactor is based on the one-group diffusion approximation. The problem is solved by the analogue

simulation method. The electric circuit and equations for the parameters of the model are presented. Problems and results of analysis of relay systems of controlling radial power distribution are discussed. (4 references) (auth)

34396 GREIFSWALD NUCLEAR POWER PLANT BRUNO LEUSCHNER. Gorski, K.; Ivanov, M. (VEB Kombinat Kraftwerksanlagenbau, Berlin). Kernenergie; 17: No. 7, 200-222 (Jul 1974). (In German).

Information is presented concerning structure of the nuclear power plant (principle of function of water-cooled and water-moderated power reactors, basic flowsheet of the power station, flowsheet of the primary cooling system, purposes and flowsheets of the special water treatment systems, flowsheet of the special gas purification system); main equipment of the nuclear power plant (reactor, upper block, and reactor installations; equipments of the coolant loops, equipments of the special water treatment system); and operating reliability and safety of the power station (control, monitoring, and emergency shut-down system of the reactor, reliability of power supply, biological shields and radiation monitoring, technological ventilation, nuclear and radiation safety in cases of primary cooling system leakage). (auth)

Nuclear Power Plant Economics

Refer also to abstracts 33931 and 34177.

34397 (BNWL-B-332) HANFORD NUCLEAR ENERGY CENTER: A PRELIMINARY CONCEPTUAL STUDY. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 25 Jan 1974. Contract AT(45-1)-1830. 321p. Dep. NTIS $19.25.

The potential benefits and problems of Nuclear Energy Centers built on Federal properties were studied by applying the concept to the Hanford area and examining two hypothetical cases: (1) adding up to two 1300 MW(e) units yearly starting in 1979, and (2) adding two 1300 MW(e) units yearly starting in 1982. The resulting generating capacity would be 20,000 MW(e) and 13,000 MW(e), respectively, in 1985, and 34,000 MW(e) and 26,000 MW(e) in 1990. Facilities for fuel enrichment, reprocessing, and fabrication and radioactive waste disposal are included in the study. The ownership and operation of the various facilities are discussed. Economic, environmental, and sociological impacts are also considered. (DG)

34398 (CEA-R-4610) NUCLEO-ELECTRIC INDUSTRY DEVELOPMENT SIMULATION MODEL. Naudet, G.; Paillot, H.; Charpentier, J. P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France)). Sep 1974. 38p. (In French). Dep. NTIS (U. S. Sales Only) $5.00.

The simulation model described gives the long term development of nuclear power generation plants under any assumptions of installed capacity and mix of reactor types. The model is sequential; it expresses as closely as possible the reactor operation in its various stages and the various industrial processes of nuclear fuel cycle. For every proposed development scheme, it fixes the installation date and the number of the reactors in every type and the corresponding nuclear fuel demand and supply. The main feature is that it gives valuable information for the analysis of the interactions between reactor type programs. It evaluates the introduction of fast breeder reactors according to the amount of plutonium produced by other national reactors or bought on the international market. The various assumptions of french nuclear energy development which had been made by PEON Commission in April 1973 has been taken into account in the application of the model used as an illustration. (auth)

34399 (KFK-1995) THE CONTRIBUTION OF NUCLEAR POWER IN MEETING THE WORLD'S ENERGY DEMAND. Bogensberger, H.; Friede, G.; Matheis, U.; Woite, G.; Zech, H. J. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik). Jun 1974. 511p. (In German). INIS.

With figs.; tabs. and refs. With abstract in German and English.

For 68 different countries, the electric power consumption up to the year 1990 is predicted. A mathematical model is applied for the extrapolation of the power demand. Due to a comparison of costs between nuclear reactors and oil or coal-fired power stations, the maximum possible capacity which can be installed in the form of nuclear reactors is estimated for each single country. (auth)

34400 (NP-20163) LECTURES: AUTUMN 1973–SPRING 1974. (CEA, 75 – Paris (France)). Jun 1974. 140p. Dep. NTIS (U. S. Sales Only) $10.00.

Seven lectures on nuclear power related topics delivered at the Norwegian Atomic Energy Association lecture series in Oslo are presented. One lecture has been individually abstracted and indexed. (DG)

For an abstract of an individual paper see: 34401.

34401 (NP-20163, pp 1-12) FRENCH NUCLEAR POWER PROGRAM AND REACTOR DEVELOPMENT IN FRANCE. Vendryes, G. (CEA, Paris). 1 Oct 1973.

The proportion of nuclear power in France is expected to increase from 9.3% in 1975 to 31% in 1985, reaching 80% by the turn of the century. While the gas-cooled natural uranium reactors have performed satisfactorily, their commercial possibilities are so reduced that the present program is based on light water reactors. Considerations of fuel utilization are the motive for development work on HTGR and LMFBR type reactors. The success of Rapsodie led to the Phenix project, now to be followed by a 1200 MW(e), commercial prototype, Super Phenix. This is part of a cooperative project between EDF, RWE and ENEL, which also includes a large LMFBR in Germany. Agreements between Gulf General Atomic and the CEA and a French industrial group form the basis of the French effort in the HTGR field. (NO)

34402 (STI/PUB-351) EXPERIENCE FROM OPERATING AND FUELLING NUCLEAR POWER PLANTS. Proceedings Series. Proceedings of a Symposium Held in Vienna, Austria, October 8–12, 1973. (International Atomic Energy Agency, Vienna (Austria)). Apr 1974. 731p. (In Several Languages). (CONF-731083-). IAEA $32.00.

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973).

Summaries of forty papers delivered at the October 1973 Vienna symposium are presented. Each paper has been separately abstracted and indexed for NSA. (DG)

For abstracts of individual papers see: 33044, 34135–34149, 34168–34174, 34194–34196, 34210–34213, 34249, 34319, 34378, 34406, 34409–34413, and 34443.

34403 FRANCE CHOOSES NUCLEAR ENERGY TO DECREASE DEPENDENCE ON OIL. Fiorentini, P. Com. Naz. Energ. Nucl., Notiz.; 20: No. 6, 64-71(Jun 1974). (In Italian).

A description of the French nuclear program approved last March 6 is presented which calls for the construction of 13 nuclear power plants of about 1000 MW(e) each to be started by 1975. Particular reference is made to French industry's participation in the implementation of this program, especially the two leading groups, Framatome–Creusot Loire and CGE. 12 references. (auth)

34404 NUCLEAR ENERGY IN SWITZERLAND. Casa, A. F.; Perilli, M. L.; Sansone, M. M. Com. Naz. Energ. Nucl., Notiz.; 20: No. 6, 54-63(Jun 1974). (In Italian).

A picture of the current status and prospects of nuclear energy in Switzerland is presented. The various nuclear power plants in operation, under construction or in the design stage, the organization of nuclear research and the Country's main national research centers are discussed. 36 references. (auth)

34405 FINAL REPORT ON THE FACT-FINDING INQUIRY ON ENERGY SOURCES. Com. Naz. Energ. Nucl., Notiz.; 20: No. 6, 25-43(Jun 1974). (In Italian).

The full text of the document approved by the Italian House of Deputies, Industry Committee, on May 2, 1974 is presented. This is the final report on an inquiry conducted by the Committee in the last few months on energy sources and on the causes of the current energy crisis. The document places particular stress on nuclear problems and discusses in detail the concrete aspects of the introduction of nuclear energy in Italy. Special emphasis is laid on the need for direct cooperation among the various sectors of the energy industry. (auth)

34406 POWER ESCALATION IN THE REACTOR CONSTRUCTION. Wild, E. A. Mitt. Mitglieder Tech. Ueberwach.-Vereins Bayern; No. 5, 151-156(1970). (In German).

A brief description of the economical advantages of the use of nuclear power is followed by an outline of the excepted development up to 1980 which will be marked by increasing power station unit sizes. Economics aspects as well as technological problems concerning the construction of large-scale plants are discussed. The technological problems are mainly concerned with the reactor core, the reactor pressure vessel, the security container, the after-heat removal in the case of an emergency and the turbines. Finally the consequences for the TUEV-organization are described. (GF)

34407 EVALUATION OF NUCLEAR POWER-PLANT AVAILABILITY. Nucl. Safety; 15: No. 5, 599-607(1974).

A study was made of nuclear and fossil power-plant operating

experience to compare plant availability and to determine the cause and safety significance of plant outages for nuclear plants. Results showed that the availability of the nuclear power plants is lower than the general design objective during the first 1 to 3 years of commercial service. Following this period of operation, however, average availability has approached or exceeded 80%. The average availability of nuclear plants has been nearly the same as that of fossil plants of approximately the same size during the 12-year period 1960 to 1971. Approximately half of the forced outages of nuclear plants resulted from events that are considered to have safety significance. In no case, however, was there injury to the public or a release of radioactive materials in excess of permissible levels. (auth)

34408 PERFORMANCE AND RELIABILITY OF OPERATING UNITED STATES NUCLEAR POWER PLANTS. Skovholt, D. J. (Atomic Energy Commission, Washington, DC). pp 3-18 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The results of an analysis of United States nuclear power plant availability are presented. It is expected that during the next few years about 20 nuclear power station units per year would become operational in the United States, so that by 1980 the total number of units in operation would amount to about 150. The operating statistics were based on experience with 19 commercial light-water-cooled plants. It was shown that a break-in period of about three to four years was required, before light-water-cooled nuclear plants would achieve the design objective of 80% availability. Four main problems were discussed which had caused major operation interruptions leading to a plant modification. These were (a) Fuel densification, which had led to power level restrictions; (b) Inconel cladding separation in steam generators, as a result of non-uniform bonding to the tube sheet of the explosively applied cladding; (c) Main steam relief system failures, which had caused three significant incidents in main steam pressure or temperature reduction systems, and which apparently stemmed from inadequacies in design considerations; and (d) Main condenser circulating water system failure, which had caused an inundation of a turbine building and flooded some safety-related equipment; the incident was the result of a deficiency in the overall plant design. A usable classification of outages is presented according to type and to components and systems. The paper concludes that the average availability for nuclear plants in recent years has been nearly the same as for fossil plants of approximately the same size during the period 1960–1971. (auth)

34409 PERFORMANCE OF NUCLEAR POWER STATIONS IN THE FEDERAL REPUBLIC OF GERMANY. Huenlich, W. H. F. (Association of German Electricity Supply Undertakings, Frankfurt am Main). pp 19-52 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

A report on the performance of nuclear power stations in the Federal Republic of Germany gives an overall view of the experience accumulated by Federal German utilities in the construction and operation of eleven plants which have been feeding electricity to the interconnected grid system. Of these 11 plants, which have a total capacity of about 2300 MW(e), particular importance is given to the operational results of the three demonstration nuclear power stations KRB, KWL, and KWO because they represent the first steps towards the commercial utilization of nuclear energy for the supply of electricity in the Federal Republic of Germany. As the first commercial stations at Würgassen and Stade were put in operation only recently, only brief information is given on their startup experience. Some mention is made of advanced design features of plants under construction, which may influence the performance of these plants with unit ratings of 800, 900, 1200 and 1300 MW(e). A preview of the planning data of Federal German utilities in the years to come should record the confidence with which the further development of nuclear power plant technology and the further improvement of plant performance is being faced. (auth)

34410 MEASURING PERFORMANCE OF NUCLEAR POWER STATION UNITS. Chase, D. B. A.; Ijas, J. (International Atomic Energy Agency, Vienna). pp 65-84 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The Agency's activities since the early 1960s in the field of operating experience with nuclear power plants are outlined. The Agency's annual report on operating experience is described briefly. A number of station performance factors such as gross capacity factor for energy performance, operation factor and time availability factor for time performance are utilized. The definition of these performance factors is summarized. A number of examples are given of the various ways of defining and using performance factors in several Member States of the Agency. A method is suggested to study the performance of nuclear power plants since their start of commercial operation by plotting the cumulative annual capacity factor against the years after start of commercial operation. The resulting graphs show that, based on past experience with commercial LWRs and GCRs, during the initial three to four years of operation a low capacity and availability could be expected for a nuclear power plant. Some ways of carrying out plant outage analysis are suggested. (auth)

34411 EXPERIENCE IN THE OPERATION OF SPANISH NUCLEAR POWER STATIONS. Alvarez de Buergo, L. (Junta de Energia Nuclear, Madrid). pp 123-131 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974). (In Spanish).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The most significant experience acquired during a period equivalent to a total of about nine operating years in a single power station is described. The three power stations are reviewed jointly, with particular reference to nuclear safety and radiological protection. In addition, reference is made to the training of operating staff in Spain and licensing. The conclusions drawn from this experience are presented. (auth)

34412 NUCLEAR ASSURANCE CORPORATION PERFORMANCE PROGRAM. Nail, J. H.; Stobbs, J. J. (Nuclear Assurance Corp., Zurich). pp 133-149 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

The Nuclear Assurance Corporation performance program is an established computer-based system for storing and analyzing detailed information on the operation and performance of nuclear power plants and nuclear fuel. The program is being widely used by both electricity utilities and suppliers as an aid for routine plant operation, identifying problem areas, providing technical information for design improvement, and increasing the reliability of power plant operation by supplying in a readily usable form relevant data from currently operating plants. Owner/operator records have been used to build a data bank of operating experience serviced by flexible computer routines for analysis, sorting, retrieval and information formating. Current operating data is being added on a regular basis. The three main areas of the program are: fuel performance consisting of gross records, fuel performance records, assembly performance, fuel design; fuel management consisting of out-of-core fuel management, in-core fuel management; and plant performance consisting of outages, abnormal and unusual occurrences, component maintenance and reliability, and plant reliability statistics. Each of the three areas and their application to typical operating and engineering problems in the nuclear industry are discussed. The current Program status and further developing is also discussed with particular emphasis on the international aspects of the data system, including impact of varying utility practices, regulatory agencies, and the problems created by time and distance. (auth)

34413 TRAINING OF PERSONNEL FOR THE POWER PLANTS OF ELECTRICITE de FRANCE. Feger, M.; Brosson, M. (Service de la Production Thermique d'Electricite de France, Paris). pp 669-686 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

France is firmly committed to the generation of nuclear power to meet consumer demand. Electricité de France has embarked on a substantial program involving the use of light-water nuclear power plants, which are more economical than the graphite-moderated gas-cooled natural uranium reactors now in operation: Four 900-MW(e) units are under construction and some fifteen other units are to go into operation between now and 1982. Such a program calls for extensive information and training on nuclear matters within the Thermal Power Production Service in order to prepare the personnel for these future plants, on the basis of the

existing thermal and nuclear plants. Appropriate training activities exist at all levels (managerial staff, foremen, operating staff, students of trade schools). Whereas staff of the plants now in operation were trained piecemeal for the individual stations concerned, given their diversity, it has been possible in the case of this series of light-water plants to organize a common training school to give basic instruction to candidates before they receive specific training on the spot at each plant and also to consider a simulator of the type available for thermal power plants. The training activity is not limited to preparing the teams responsible for the startup of power plants but is continued during operating so as to ensure not only circulation of the knowledge acquired but also to impart techniques which would qualify staff in existing or new plants. (auth)

34414 NUCLEAR POWER TODAY AND TOMORROW. Umsch. Wiss. Tech.; 74: No. 13, 424-425(Jul 1974). (In German).
1 ref.
The cost explosion of Middle East oil has focussed world attention on available substitutes. Though the share of nuclear power would not exceed 10% of the total primary energy by 1985, for many decades to come the world will have to rely on an ever increasing extent of nuclear energy. A discussion is held on the prospects until the year 2000, on uranium resources, enrichment services and separation work costs, and finally on the merits of the fast breeder reactors, including the problems of plutonium handling. (auth)

34415 COMPARATIVE STUDY OF COST, MATERIAL, AND LABOR EXPENDED IN NUCLEAR AND THERMAL POWER PLANTS TAKING INTO ACCOUNT FUEL SUPPLY ENTERPRISES. Belostotskii, A. M.; Bykov, A. I. At. Energ. (USSR); 37: No. 2, 108-112(Aug 1974). (In Russian).
The results of comparative analysis of cost, material and labor expended in constructing nuclear and fossil fuel power plants taking into account fuel supply enterprises are presented. An analysis of the rise in cost of nuclear power plants proper relative to thermal power plants is included. (18 references) (auth)

34416 KERNENERGIE IN SCHLESWIG-HOLSTEIN. Vortraege Gehalten auf dem Hochschultag 1973 der Fachhochschule Luebeck am 27. Maerz 1973. (Nuclear Energy in Schleswig-Holstein. 1973 College Conference of the Luebeck Technical School, Luebeck, Germany, March 27, 1973). Taurit, R. (ed.). Munich; Verlag Karl Thiemig AG (1974). 96p. (CONF-730366-).
From College conference of technical school; Luebeck, F. R. Germany (27 Mar 1974).
The five papers presented at the conference are compiled. The topics discussed were the energy situation in the German Federal Republic and particularly in Schleswig-Holstein, nuclear power plants in Schleswig-Holstein, safety of nuclear power plants, radiation burden from radioactive materials, and description of the research center in Geesthacht-Tesperhude. (JSR)

34417 STATUS AND PROSPECTS OF THE NUCLEAR POWER PROGRAM IN SWEDEN. Com. Naz. Energ. Nucl., Notiz.; 20: No. 7, 71-75(Jul 1974). (In Italian).
After some brief comments on the present energy picture, the article reviews the nuclear power plants now in operation or under construction. The new program has been postponed till 1975 at the earliest, waiting for stronger assurances as to the safety of water reactors. (auth)

34418 ROLE OF FAST REACTORS IN NUCLEAR POWER. Stach, V. (Inst. of Nuclear Research, Rez, Czech.). Nukleon; No. 2-3, 5-15(1973). (In Czech).
The advantages of fast reactors are outlined with regard to the efficient utilization of nuclear fuel resources. The current status of fast reactor development in the world is characterized and the integration is discussed of fast reactors into the electric power system in Czechoslovakia. (Nucl. Sci. Abstr. Czech.)

34419 MULTIPURPOSE USES OF NUCLEAR POWER IN CHEMICAL INDUSTRY. Usui, K. (Showa Denko K. K., Tokyo). Karyoku Genshiryoku Hatsuden; 24: No. 5, 594-599(May 1973). (In Japanese).
The energy consumption in chemical industries is comparable even to that in iron and steel making, and the proportion of energy cost in product value is considerable. In chemical industry complexes, the utilization of nuclear energy emerges as important owing to petroleum conservation and environmental considerations. The following are described: multiple uses of nuclear energy in chemical industries; multi-purpose nuclear reactors; present state of the multiple utilization of light water reactors; and an example of the multi-purpose nuclear power station. The current employment of light-water reactors for chemical industry complexes is due to the technological level with proved safety and economy. BASF in West Germany and the Midland project in the United States are current instances of the utilization. The petrochemical complex for the ethylene production of 2,000,000 tons per year as envisaged in Japan is explained; it employs a nuclear power station with BWR or PWR for supplying process steam and desalinating sea water. (JA)

34420 NUCLEAR ENERGY. I. An Effective Competitor. Leslie, D. C. (Queen Mary Coll., London). pp 65-79 of Energy: from Surplus to Scarcity. Inglis, K. A. D. (ed.). Barking, Eng.; Applied Science Publishers Ltd. (1974).
From conference on energy: from surplus to scarcity; Harrogate, England (5 Jun 1973).
The world's resources of fossil fuels and uranium deposits are considered and the comparative costs of nuclear power and oil are estimated. The main types of nuclear reactors are described, with brief discussions of the short-term market for nuclear power, and of environmental issues. (UK)

34421 ATOMNOI ENERGETIKE XX LET. (Atomic Power Over 20 years). Malyavina, O. M. Moscow; Atomizdat (1974). 215p.
The history of the development of Soviet reactors is covered. Technical details are presented on the first Soviet commercial-scale reactor at Obninsk having a rated power of 5000 kilowatts. A description of the pressurized water reactors at Novo-Voronezh is given. These reactors have power output varying from 210 to 1000MW(e) with ^{235}U fuel enrichments from 2 to 5%. The Beloyarsk nuclear power plant near Sverdlovsk is described. Descriptions are given for the reactor at Leningrad, the boiling water reactor at Dimitrovgrad, a heavy-water reactor with gas cooling in Czechoslovakia, and various fast neutron reactors. Research reactors and ship reactors are described. (SJR)

34422 MANAGEMENT CONCEPTS FOR NUCLEAR POWER PROJECTS. Nixon, V. D. (Bechtel Power Corp., Los Angeles). At. Energy Rev.; 12: No. 3, 553-564(1974).
The increased size and complexity of nuclear plants, together with a growing public involvement in regulatory processes, underscore the need for improved management concepts. This requirement for quality management is being increasingly recognized within the nuclear power industry. There are a number of management approaches to nuclear project implementation. An overview of these various concepts is presented. One such concept is the "turnkey" approach, which has been used extensively in Europe as well as in certain of the developing nations. In the United States of America, however, increased plant complexity and growing public concern relative to environmental impact and safety has led to increased acceptance of the "integrated management" concept. Integrated management is a concept that involves the engineer-manager in all facets of the project from its inception to completion. This method, which involves extensive interfacing of the various disciplines, provides a cohesive, effective method of management control and direction. (auth)

34423 INSERVICE INSPECTION PROGRAMMES IN THE UNITED STATES. Lautzenheiser, C. E. (Southwest Research Inst., San Antonio). Int. J. Pressure Vessels Piping; 2: No. 1, 1-17(Jan 1974).
The history and status of inservice inspection of commercial nuclear power stations is summarized, and some of the problems facing both the utility and the inspection agency are outlined. A brief summary of the equipment developed in various countries for remote inspection shows that equipment availability is not a major problem. The experiences of the Southwest Research Institute in preoperational and inservice inspection of both BWR and PWR plants, which are discussed, illustrate the more unusual problems encountered. An appendix lists in some detail the requirements for ultrasonic examination of materials. (UK)

Reactor Fuel Cycle Economics

Refer also to abstracts 34253 and 34412.

34424 (FRNC-CONF-104) ASPECTS OF THE USERS STANDPOINT REGARDING THE NUCLEAR FUEL CYCLE. Kieffer, J. (Electricite de France, 75 - Paris). 1973. 16p. (In French). (CONF-730983-7). Dep. NTIS (U. S. Sales Only) $4.00.
From congress of the Society of Electrical, Electronic and Radio Engineers meeting; Vittel, France (11 Sep 1973).
Fuel plays an important role in the production of thermal electricity. Nuclear fuels have brought several innovations in this field. The nuclear plant operator must recharge the reactor at intervals. The report reviews the factor bearing on recharge frequency: performance, length of the cycle, use of the plant, failures, etc. These problems are even more complex in the case

of a group of nuclear facilities, for which start-ups, operating programs, closedowns and fuel stocks must be managed in coordination. They call for the constitution of skilled nuclear management personnel if the operator is to remain master of these costs of production. (FR)

34425 MATHEMATICAL MODEL OPTIMIZING THE FUEL SUPPLY SYSTEM OF DEVELOPING NUCLEAR POWER. Virtser, A. D.; Koryakin, Yu. I.; Lokshin, V. L.; Chernavskii, S. Ya. At. Energ. (USSR); 37: No. 2, 113-117(Aug 1974). (In Russian).

The basic principles adopted in creating a mathematical model of the fuel supply system of developing nuclear power are presented. There is given a description of the mathematical model itself, which permits optimization of the introduction periods and power of external fuel cycle enterprises, as well as their charge, taking into account the dependence of capital investment and cost of production on the power of the enterprises. 8 references. (auth)

Reactor Licensing and Regulation

34426 (DOCKET-50155-307) BIG ROCK POINT NUCLEAR PLANT. Semiannual Operations Report No. 20, January – June 1974 and Tabulation of Personnel Receiving More Than 500 mRem Exposure During the Period July – December 1973. (Consumers Power Co., Jackson, Mich. (USA)). 29 Aug 1974. 88p. Dep. NTIS $7.50.

The plant was base loaded at 53 MW(e) during this period except for a one week run at 71 MW(e). The start of the refueling outage on 3/23/74 marked the end of cycle 11 in which a total of 461,582 MWh(e) was produced. Cycle 12 power operation began 5/5/74 and ended on 6/2/74 at which time the 12th refueling outage was initiated which was still in progress at the end of the period. A total of 39,451 MWh(e) was generated. Data is presented concerning operation, power generation, shutdowns, safety related maintenance, changes, tests experiments, radioactive effluent releases, environmental monitoring, and personnel radiation exposures. (FS)

34427 (DOCKET-50244-329) ROBERT EMMETT GINNA NUCLEAR POWER PLANT, UNIT 1. Semiannual Report No. 9, January – June 1974. (Rochester Gas and Electric Corp., N.Y. (USA)). 31 Aug 1974. 56p. Dep. NTIS $6.00.

In this period, unit power levels ranged from 0 to 70% (1064 MW(t) of the full licensed power of 1520 MW(t)). The station output was approximately 350 net MW(e). Data are presented concerning operations, modifications, procedure changes, surveillance, containment leak rate tests, personnel changes and training, power generation, shutdowns, maintenance, radioactive effluents, environmental monitoring, occupational personnel radiation exposure, and primary coolant chemistry. (FS)

34428 (DOCKET-50245-412) MILLSTONE NUCLEAR POWER STATION, UNIT 1. Semiannual Operating Report, January – June 1974. (Northeast Nuclear Energy Co., Hartford, Conn. (USA)). 28 Aug 1974. 21p. Dep. NTIS $4.25.

Reactor operations and abnormal occurrences are summarized. Changes in technical specifications, key supervisory personnel, and plant design are briefly described. Statistics are presented concerning power generation, plant performance, radioactive effluents, occupational personnel radiation exposure, environmental sampling, and safety related maintenance. (FS)

34429 (DOCKET-50255-346) PALISADES NUCLEAR PLANT. Semiannual Report of Operations, January – June 1974. (Consumers Power Co., Jackson, Mich. (USA)). 30 Aug 1974. 61p. Dep. NTIS $6.25.

The Palisades plant was shutdown during the entire period. Investigation and repair of the steam generator tubes were conducted throughout most of the period. New corrosive attack of the tubes was observed in May. Inspection, modification and repair of the reactor vessel internals and the first year turbogenerator inspection were completed. In addition, the closed cycle condenser cooling system, which was constructed pursuant to the Intervenor Agreement, was completed. (FS)

34430 (DOCKET-50261-425) H. B. ROBINSON PLANT, UNIT 2. Semiannual Operating Report No. 8, January – June 1974. (Carolina Power and Light Co., Raleigh, N. C. (USA)). 29 Aug 1974. 318p. Dep. NTIS $19.00.

The first four months of the six-month period constituted routine operations. Effort during this time was directed toward preparations and planning for the 1974 refueling outage. The final two months of the period involved refueling operations. Reports by month concerning plant operation, abnormal occurrences, generation, thermal power, outages, and maintenance are presented. Surveillance tests and inspections including periodic refueling, cycle 3 start-up, containment integrity, valve wall inspection, and inservice tests are discussed. Modifications, operating changes, performance characteristics, and waste management are described. (FS)

34431 (DOCKET-50263-413) MONTICELLO NUCLEAR GENERATING PLANT, UNIT 1. Semiannual Operating Report No. 7, January – June 1974. (Northern States Power Co., Minneapolis, Minn. (USA)). 30 Aug 1974. 118p. Dep NTIS $9.00.

Reactor operation is described including summaries of operation and maintenance, shutdowns, power generation, changes, tests and experiments, radioactive effluent releases and environmental monitoring. (FS)

34432 (DOCKET-50277-310) PEACH BOTTOM ATOMIC POWER STATION, UNIT 2. Semiannual Operations Report No. 2, January – June 1974. (Philadelphia Electric Co., Pa. (USA)). 29 Aug 1974. 53p. Dep. NTIS $5.75.

An attempt at generator start-up was marred by a ground fault of the generator rotor, which was repaired, and the unit was synchronized to the bus on 2/16/74. By 3/18/74, the required start-up testing at 25% power was completed. The 50% power testing was completed 4/18/74 and the 75% on 5/16/74. The 100% power testing verified the plants operational readiness. All start-up testing was completed by 5/28/74. The first eight days of June were spent in readying the plant for full power operation. The plant operated at or near full power for the remainder of the month except for four shutdowns. Information on equipment is presented including: performance changes and fatigue; maintenance; radioactive waste release; occupational radiation exposure; and administration activities. (FS)

34433 (DOCKET-50293-338) PILGRIM NUCLEAR POWER STATION, UNIT 1. Semiannual Report No. 4 on Operating and Maintenance, January – June 1974. (Boston Edison Co., Mass. (USA)). 1974. 67p. Dep. NTIS $6.50.

The reactor was shutdown during the entire period for a refueling outage and legal intervention. This unscheduled outage resulted from an AEC order to shutdown and maintain the reactor in a safe condition until any fuel channel to poison curtain interaction damage was repaired. All activities required of a major refueling outage in addition to correcting fuel channel to poison curtain interaction damage were performed. Data is presented on operating statistics, maintenance, radioactive effluents environmental monitoring, primary local leak rate testing, and drywell-suppression chamber vacuum breaker leak rate testing. (FS)

34434 (DOCKET-50460-40) WPPSS NUCLEAR PROJECT NOS. 1 AND 4. License Application, Amendment 1. (Washington Public Power Supply System, Richland (USA)). 22 Jul 1974. 195p. (DOCKET-50513-4).

WNP-4 is to be a twin reactor to WNP-1 and will be located at the Hanford Reservation near Richland, Washington in Benton County. This facility will consist of the two PWR type reactors, each with a core power level of 3600 MW(t). The only systems which will be shared are the off-site electrical system, the cooling tower make-up and blow-down systems and the meteorological monitoring system which will also be shared with WNP-2. The financial report of the applicant is given. (FS)

34435 (FIND-50461) FIND: CLINTON POWER STATION, UNITS 1 AND 2. Horn, F. H. (ed.). (USAEC Technical Information Center, Oak Ridge, Tenn.). Oct 1974. 36p. Dep. NTIS $4.00.

An index is presented for the docket report material submitted in conjunction with the application for a nuclear power plant construction permit and operating license. The index citations are to the beginnings of major heatings, sections, responses, etc., and refer to grid coordinates on microfiche sheets prepared for each docket report. (DCC)

34436 (DOCKET-STN-50518-1) HARTSVILLE NUCLEAR PLANTS, UNITS 1, 2, 3, AND 4. License Application. (Tennessee Valley Authority, Knoxville (USA)). 1974. 113p. (DOCKET-STN-50519-1; DOCKET-STN-50520-1; DOCKET-STN-50521-1). Dep. NTIS $8.75.

An application is presented for construction and operation of four BWR/6 type reactors, which will be located in Smith and Trousdale counties in Tennessee about 40 miles northeast of Nashville, 5 miles east of Hartsville, 1½ miles west of Dixon Springs on the Cumberland River. Cooling towers will be provided. Each reactor will be rated at 3579 MW(t) and each turbogenerator at 1,220 MW(e). In-plant electrical power consumption will be 38 MW(e). Full power operation of the four units is expected in December 1980, June 1981, December 1981, and June 1982. (FS)

34437 (NP-20166) LICENSING TOPICAL REPORT ON GENERAL ATOMIC QUALITY ASSURANCE PROGRAM. (General Atomic Co., San Diego, Calif. (USA)). 10 Sep 1974. 54p.

A description of the General Atomic Quality Assurance Program for the design and construction of the nuclear steam supply portion of a High Temperature Gas Cooled Reactor (HTGR) is presented. This report establishes the General Atomic Quality Assurance baseline from which the Quality Assurance Manual will be prepared and implemented. (auth)

34438 (PRDI-74-10) TITLE LISTING OF POWER REACTOR DOCKET INFORMATION. (USAEC Technical Information Center, Oak Ridge, Tenn.). Oct 1974. 59p. TIC $1.45.

Citations and subject indexing to the documentation associated with civilian nuclear power plants are presented. This material is that which is submitted to the Atomic Energy Commission in support of applications for construction and operating licenses. Citations are listed by Docket number in accession number sequence. The Table of Contents is arranged both by Docket number and by nuclear power plant name. (DCC)

34439 (RAI-74-8) REGULATORY ADJUDICATION ISSUANCES AND ISSUANCES OF THE BOARD OF CONTRACT APPEALS, AUGUST 1974. (USAEC Technical Information Center, Oak Ridge, Tenn.). Sep 1974. 169p.

Issuances received from the U. S. Atomic Energy Commission, the Atomic Safety and Licensing Appeal Boards, and the Atomic Safety and Licensing Boards are presented. (DG)

34440 (REG/G-1.26(Rev.1)(9-74)) QUALITY GROUP CLASSIFICATIONS AND STANDARDS FOR WATER-, STEAM-, AND RADIOACTIVE-WASTE-CONTAINING COMPONENTS OF NUCLEAR POWER PLANTS. (USAEC Directorate of Regulatory Standards, Washington, D. C.). Sep 1974. 3p. DRS Free.

This guide describes a quality classification system related to specified national standards that may be used to determine quality standards acceptable to the Regulatory staff for satisfying General Design Criterion 1 for other safety-related components containing radioactive material, water, or steam in water-cooled nuclear power plants. (auth)

34441 (REG/G-1.70.7) ADDITIONAL INFORMATION: GEOGRAPHY AND DEMOGRAPHY CONSIDERATIONS FOR NUCLEAR POWER PLANTS. (USAEC Directorate of Regulatory Standards, Washington, D.C.). Aug 1974. 3p.

This guide identifies information related to geography and demography considerations that has often been missing from the applicant's safety analysis report at the construction permit and operating license stages of review. (auth)

34442 FUTURE DEVELOPMENT OF ATOMIC ENERGY LAW. Lukes, R. Neue Juristische Wochenschr.; 26: No. 28, 1209-1215 (Jul 1973).

The article deals mainly with the future development of the atomic energy law of the FRG. Future development trends in the supranational and international law which will influence the national law of the FRG are also mentioned. The development of the German atomic energy law is discussed with a view to the following aspects: organization, radiation protection and health physics, licensing procedures and regulations in the field of nuclear technology; some of the main trends are outlined in particular. (GE)

34443 REACTOR OPERATOR TRAINING PROGRAMS UTILIZING NUCLEAR POWER PLANT SIMULATORS. Collins, P. F. (Atomic Energy Commission, Washington, DC). pp 643-667 of Experience from Operating and Fuelling Nuclear Power Plants. Vienna; International Atomic Energy Agency (1974).

From symposium on experience from operating and fuelling nuclear power plants; Vienna, Austria (8 Oct 1973). See STI/PUB-351; CONF-731083-.

Individuals must obtain licenses from the USAEC to operate controls of nuclear facilities in the United States of America. To obtain licenses, individuals must pass USAEC examinations. Some individuals must be examined prior to initial criticality at a facility. Individuals must have extensive actual operating experience at a comparable reactor to sit for these examinations. They may obtain operating experience by completing USAEC-approved training programs that utilize nuclear power plant simulators. The USAEC has accepted four such training programs since 1969, which are administered by the nuclear power plant system vendors. The programs consist of: (1) nuclear fundamentals courses; (2) research reactor operations; (3) nuclear power plant design lectures; (4) observation at operating nuclear power plants; and (5) simulator operations. Individuals seeking licenses after plants become operational must demonstrate their proficiency at reactor controls during examinations. In 1971, the USAEC approved the use of simulators in training programs for these individuals and has utilized simulators during the examinations. These programs are limited to personnel whose control rooms closely parallel that of the simulator. The USAEC requires that licensed individuals participate in requalification programs. The program requires that licensees manipulate reactor controls through a specified number of evolutions during their license tenures. To minimize the number of plant evolutions solely for requalification, manipulation of simulator controls is permitted, providing the simulator's operating characteristics and control room are similar to that of the facility involved. Final evaluation of the merits of using simulators in place of control manipulation at operating plants is the knowledge and understanding exhibited by trainees during the administration of examinations. USAEC examiners have found that individuals trained using simulators have a better understanding of plant responses to transient conditions and abnormal situations. Also, they have found trainees more confident when responding to questions that require prediction of plant responses to postulated situations. Also, simulators are an extremely effective means for examining and evaluating individuals. The USAEC believes that simulators, used in conjunction with comprehensive training programs, are effective training devices, and intend to encourage use in future training programs. (auth)

GENERAL

Civilian Defense

34444 ORUZHIE MASSOVOGO PORAZHENIYA I ZASHCHITA OT NEGO: UCHEBNOE POSOBIE. (Weapons of Mass Destruction and Protection from Them: Training Manual). Belykh, G. A. Moscow; Izdatel'stvo Dosaaf (1973). 80p.

Effects of a nuclear blast are described under the following categories: blast wave, thermal effects, penetrating radiation, and contamination. Properties of the following poisonous gases and their effects are described: sarin, soman, U-gases, hydrogen cyanide, yprite, lewisite, phosgene, BZ, and CS. Various viruses and other biological warfare agents are described. The use of protective clothing against radioactive and chemical poisons is described. The operation of chemical and radiation survey instruments is illustrated and explained. Methods of decontamination from radioactivity and deactivation of poisonous gases are given. First aid measures are demonstrated pictorially. (SJR)

Energy Utilization and Economics

34445 (BNL-18984) ENERGY SYSTEMS ANALYSIS AND TECHNOLOGY ASSESSMENT PROGRAM. Annual Report, Fiscal Year 1974. Hoffman, K. C.; Beller, M. (eds.). (Brookhaven National Lab., Upton, N. Y. (USA)). Jun 1974. 345p. Dep. NTIS $20.25.

The second annual progress report described the overall objectives of the program and a summary of the major activities during 1974. The highlights of the program include the development of the Energy Model Data Base and associated manipulative computer programs, the completion of a series of technology assessments, and a study of an intensive electrification strategy. Individual assessments of thirty energy technologies were performed in support of the formulation by the AEC chairman of a $10 billion national energy research and development program. Strategic planning scenarios were prepared. The intensive electrification study involved an evaluation of the substitution of coal and nuclear electric power for imported oil in the 1985 and 2000 time periods. The analytical techniques or models that were developed and are employed in the program are the Reference Energy System (RES) and the Brookhaven Energy System Optimization Model (BESOM). (MCW)

34446 (BNWL-SA-4471) ENERGY FROM SOLID WASTE BY PYROLYSIS-INCINERATION. Hammond, V. L.; Mudge, L. K.; Allen, C. H.: Schiefelbein, G. F. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Nov 1972. 16p. (CONF-721156-1). Dep. NTIS $4.00.

From meeting of the Air Pollution Control Association; Eugene, Oregon, USA (15 Nov 1972).

The technology for conversion of solid waste to energy in the form of low Btu gas was demonstrated. The gasification of solid waste offers the potential of helping to conserve natural resources; reducing land, water, and air pollution; and reducing the cost of solid waste disposal. The economics indicate that any region with a population of more than 75,000 people can dispose of solid waste by gasification at less cost than by landfill if there is a demand for low Btu gas. The problems that were identified were solved by designs that were used for large-scale facilities for production of low Btu gas from coal. The development of the Battelle-Northwest gasification process (pyrolysis-incineration) is described. (MCW)

34447 (CONF-741104-3) COMPARATIVE PERFORMANCE CHARACTERISTICS OF CYLINDRICAL PARABOLIC FOCUSING AND FLAT PLATE SOLAR ENERGY COLLECTORS. Tester, J. W.; Mayer, R. M.; Fraas, A. P. (Oak Ridge National Lab., Tenn. (USA)). 1974. 32p. Dep. NTIS $5.00.

From winter meeting of the American Society of Mechanical Engineers; New York, New York, USA (17 Nov 1974).

Experimental performances of flat plate and cylindrical parabolic focusing solar energy collectors were compared for simultaneous operation under Oak Ridge, Tennessee weather conditions. The flat plate collection system was of conventional design while the focusing collector was a low concentration factor, fixed orientation device that employed a finned tube receiver. The importance of seasonal and diurnal variations in the Sun's alignment was critical to performance of the focusing collector and was considered in detail. Performance models were developed to predict monthly operation under Oak Ridge weather conditions. The economics of utilizing either system for domestic space heating and air conditioning are discussed. (auth)

34448 (JUL-1069-RG) REACTION TECHNICAL DESIGN OF CONVENTIONAL AND NUCLEAR HEATED CRACKING PLANTS FOR OLEFIN PRODUCTION. Niessen, H. F. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). May 1974. 134p. (In German). Dep. NTIS (U. S. Sales Only) $9.75.

Thesis. Submitted to Technische Hochschule, Aachen (West Germany).

A calculating model is developed, which, depending on the free radical mechanism, enables the calculation of products during the cracking of higher hydrocarbons (naphtha) for olefin production. The validity of the model is proved in comparison with measurements in laboratories and with measurements of a commercial pilot plant. For coupling heat high-temperature reactors into the process of olefin production the following possibilities are discussed: heated crack-tubes (with helium or steam) and carrier-heat process (high and low pressure). The steam crackers are optimized with regard to the residence time and the steam dilution. The originating fraction of methane is led to a steam reforming process for the production of hydrogen. For the different processes detailed energy balances and mass balances are not only given for the cracking but also for the necessary gas separation plants. (auth)

34449 (LA-5606-PR) THERMOCHEMICAL PRODUCTION OF HYDROGEN FROM WATER. Quarterly Report, January 1–March 31, 1974. Bowman, M. G. (comp.). (Los Alamos Scientific Lab., N. Mex. (USA)). May 1974. Contract W-7405-eng-36. 13p. Dep. NTIS $4.00.

The Thermochemical Hydrogen Program at the Los Alamos Scientific Laboratory is investigating thermochemical cycles for production of hydrogen. The chemical reactions of three such cycles have been demonstrated. Additional cycles are being developed. The investigations discussed here are of the continuing type. Results and conclusions may be changed or augmented as the work continues. Published reference to results cited in this report should not be made without obtaining explicit permission to do so from the person in charge of the work. (auth)

34450 (LA-UR-74-1604) MODELING AND HYBRID SIMULATION OF SOLAR ENERGY SYSTEMS. Murray, H. S. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 9p. (CONF-741001-1). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

A detailed model of a solar energy system is presented. The model includes a description of the dynamics of a single-glazed flat plate solar collector, energy storage system, and building. A hybrid computer implementation is chosen for the model. For controls studies, many of the faster time constants of the system must be retained, and this level of detail is readily accommodated on the hybrid computer. One year of operation is simulated on the hybrid computer in 8.76 minutes, or at a rate of sixty milliseconds of computer time per one hour of real time. This allows an economical evaluation of an entire year of operation using various control modes and parameters. Actual data for ambient temperature, wind velocity, relative humidity, and horizontal insolation (incident solar flux) are used to force the model. A year's worth of hourly data is stored on disk and played back through digital-to-analog converters. Insolation data is pre-processed to account for the incident angle on the collector and building sides and roof, and for the angular dependence of absorptivity and reflectivity of the glazing. A digitally-controlled analog data reconstruction scheme is used to produce the required inputs to the analog portion of the model. The technique consists of straight line reconstruction of the hourly data coupled with stochastic reconstruction of the higher frequency variations. (auth)

34451 (ORNL-EIS-74-52(Vol.2)(No.6)) NSF-RANN ENERGY ABSTRACTS. A Monthly Abstract Journal of Energy Research. Guthrie, M. P. (Ed.). (Oak Ridge National Lab., Tenn. (USA)). Jun 1974. Contract W-7405-eng-26. 88p. Dep. NTIS $7.50.

The bibliography disseminates as rapidly as possible the published results of work performed under the Energy Research and Analysis category of RANN. Other energy research results will also be covered as far as possible. The bibliography, in general, covers research on energy sources, electric power (generation, supply and demand, transmission, environmental effects, and use), and energy (production, consumption, supply and demand, and policy). The research publications cited are technical journal articles, popular or semi-technical magazine articles, topical

reports, symposium papers and proceedings, monographs, and books published within the past two years. A total of 62 abstracts is included. (MCW)

34452 (SLA-74-5288) SIZING OF FOCUSED SOLAR COLLECTOR FIELDS WITH SPECIFIED COLLECTOR TUBE INLET TEMPERATURE. Lee, D. O.; Schimmel, W. P. Jr.; Abbin, J. P. Jr. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 43p. (CONF-741104-2). Dep. NTIS $5.25.

From winter meeting of the American Society of Mechanical Engineers; New York, New York, USA (17 Nov 1974).

An axial temperature differential analysis has been used to size the collector field required to power Sandia Laboratories' demonstration project in which 40 kW (electrical) output is required. The number of collectors required to furnish the desired energy and temperature rise in the collector fluid is determined by the requirements of several typical organic working fluid Rankine-cycle energy conversion systems. Calculations based on heliostatically-mounted collector systems and fixed tilt east–west tracking collector systems are presented. The collector matrix sizes obtained by these calculations are somewhat optimistic because the effects of wind losses and shadowing by adjacent collectors are not considered. In addition, no losses are considered for connections between collectors. However, losses in the Rankine cycle power conversion loop are considered. This analysis is thus valid for a lossless, "infinitely" spaced collector field. (auth)

34453 (UCID-51600) METHYL ALCOHOL PRODUCTION BY IN SITU COAL GASIFICATION. Pasternak, A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Aug 1974. Contract W-7405-eng-48. 23p. Dep. NTIS $4.00.

The transportation sector is almost completely dependent upon crude oil as the raw material source for fuel. The need to use the large coal deposits of the U.S. as the raw material source is discussed. Methyl alcohol can be produced from coal and used as a transportation fuel in internal combustion engines. The production route involves gasification of coal to carbon monoxide and hydrogen (synthesis gas) and high-pressure catalytic conversion of these gases to methyl alcohol. In situ gasification of coal may be a less expensive way to produce synthesis gas than mining coal and gasifying it in surface plants. In situ gasification may also have less environmental impact and may be capable of using deep coal seams that cannot be mined economically. A process for in situ gasification leading to methyl alcohol production is described, and the thermodynamics and costs of the process are outlined. Capital requirements are estimated to be $354 million for annual production of methyl alcohol with a fuel value of 81 trillion Btu's. The selling price is estimated to be $1.04 per million Btu's (5.9¢ per gallon). Adding distribution costs to these production costs, it is estimated that methyl alcohol could reach service station pumps at a price competitive with gasoline. (auth)

34454 U. S. ENERGY RESEARCH AND DEVELOPMENT PROGRAM. Grenon, M. Rev. Fr. Energ.; 25: No. 260, 349-355(Feb 1974). (In French).

The U. S. A. intends to invest some 25 billion dollars in improving techniques for producing, converting, and utilizing energy as well as investigating new sources. The most important aspects of the program are presented, and the five principal duties are analyzed. Energy conservation, enhancement in petroleum and natural gas production, hydrocarbide substitution by coal, confirmation of the nuclear choice, and expoitation of renewable energetic resources are discussed. (FR)

Information Handling

34455 (CONF-740927-1) TIC DATA-BASE EXPANSION TO INCLUDE ENERGY INFORMATION. Vaden, W. M.; Bost, D. E.; Kawakami, N. (USAEC Technical Information Center, Oak Ridge, Tenn.). 1974. 9p. (SM-189/21). Dep. NTIS $4.00.

From international symposium on information systems; connection and compatibility; Varna, Bulgaria (30 Sep 1974).

The AEC's Technical Information Center (TIC) is making a major expansion of its computerized information data base through the addition of nonnuclear energy information. This information is being processed by using the same standards as used for the 450,000 nuclear information items already machine searchable. Input processing involves the usual cataloging and indexing procedures, including report acquisition and journal scanning, but, where available, information is also being obtained by means of machine searches of existing magnetic tape files obtained from outside sources. Both cataloging and subject indexing are being converted to INIS standards before inclusion in the TIC data store. (1 table) (auth)

34456 (DEU-73-10(v. 1)) SHORT DESCRIPTION OF INFORMATION STORAGE AND RETRIEVAL SYSTEMS. I. (Gesellschaft fuer Mathematik und Datenverarbeitung m.b.H., Bonn (F. R. Germany). Abt. fuer Behoerdliche DV-Systeme). Jun 1972. vp. (In German).

This is a compilation of system descriptions of information storage and retrieval systems with a wide range of applications: DIRAC (Date, Integer, Real, Alphanumeric and Coded), MARS VI (Multi-Access Retrieval System), MODAS 2 (Model Data Bank System 2), TDMS (Time Shared Data Management System), UL 1 (User language 1). For comparative purposes the main features are listed: producers, range and types of application, hardware, input/output devices, software and other programming parameters, physical basis of storage media, logical data, user languages etc. (GE)

34457 (DEU-73-10(v. 2)) SHORT DESCRIPTION OF INFORMATION STORAGE AND RETRIEVAL SYSTEMS. II. (Gesellschaft fuer Mathematik und Datenverarbeitung m.b.H., Bonn (F. R. Germany). Abt. fuer Behoerdliche DV-Systeme). Sep 1972. vp. (In German).

This is a compilation of system descriptions of information storage and retrieval systems with a wide range of applications: ADABAS (adaptable data bank system), GOLEM (large-storage oriented list organized search method), IMS 2 (Information Management System/360), INFOL (Information oriented language), STAIRS (Storage and information retrieval system) and System 2,000. For comparative purposes the main features are listed: producers, range and types of applications, hardware, input/output devices, software and other programming parameters, physical bases of storage media, logical data, user languages etc. (GE)

34458 (EUR-5058) FIRST EUROPEAN CONGRESS ON DOCUMENTATION SYSTEMS AND NETWORKS, LUXEMBOURG, 16–18 May 1973. (Commission of the European Communities, Luxembourg). 1973. 397p. (CONF-730533-).

The First European Congress on Documentation Systems and Networks convened on May 16, 17, and 18, 1973 in Luxembourg. Its purposes are to study ways and means of using technological projects to provide better information and to put man's knowledge to better use. Papers presented were: inauguration of a system of sectorial user networks; serving six user areas from the INSPEC database; data processing problems during photocomposition of Food Science and Technology Abstracts; report of single language groups D1–D2, E1–E2–E3, and F1–F2–F3; ASSASSIN–a system capable of serving local retrieval needs and inter-company networks; a comparative study of terminal user techniques in four European countries on a large common on-line interactive information retrieval system; CAB–an agricultural information network; report of the single language groups D3–D4, E4–E5–E6, and F4–F5–F6; fundamental aspects of the financing of information centers; current trends in making information centers self-supporting by charging for the services; The S. D. I.–a second generation; CIDST, cooperation on scientific and technical documentation within the European Community; and UNISIST, an international effort to relate the free flow of scientific and technical information. Abstracts on free communications are included. (MCW)

34459 (RT/EDP-(74)3) INFORMATION SYSTEMS AND TRADITIONAL SOURCES IN INFORMATION: THE LINGUISTIC-COMPUTATIONAL APPROACH. Calabrese, A.; Casadei, G.; Cipolli, C.; Maioli, C.; Valenti, M. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). May 1974. 20p. (In Italian). Dep. NTIS (US Sales Only) $4.00.

Following an examination of the conditions required for an automatic treatment of information in the immediately discursive form typical of traditional sources, the features of an informative system for their generalized treatment are outlined. An heuristic automatic discourse analysis algorithm (AAD) is given based on recovering of synonymies and informative redundance. (auth)

34460 (WASH-1332(74)(Vol.1), pp 549-567) COMPUTERIZED INDUSTRIAL WASTE MANAGEMENT INFORMATION SYSTEM. Nelson, R.; Wehmann, G. (Atomic Energy Commission, Idaho Falls, ID). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

The reporting and documenting of information on the levels of industrial wastes (nonradioactive) discharged from AEC facilities have become more important in recent years. A computerized industrial waste management information system (IWMIS) was developed at the National Reactor Testing Station (NRTS) and has been in use since January 1974. The system provides for timely

and accurate reports on the amount of all types of industrial waste which has been stored and disposed at the NRTS. The system also provides information on fuel oil usage and water usage and disposal. The IWMIS provides monthly and year-to-date reports. The system is designed to standardize the reporting of all forms and types of waste disposed or stored at the NRTS. The data is input on a monthly basis on a specially designed form by all NRTS contractors. Computerization of the data provides considerable flexibility in making various data readily available from a single data base. The system will be an effective management tool in the management of industrial waste at the NRTS. (auth)

Law

Refer also to abstracts 32018 and 34470.

34461 (PB-174306) STATE LEGISLATION AND REGULATIONS INVOLVING IONIZING RADIATION, 1965. Thilbeau, P. A. National Center for Radiological Health, Rockville, MD (USA) Jan 1967. 47p. (PHS-PUB-1574). NTIS $6.00.

While public health laws have been in existence for many centuries, the legislative history of protection against ionizing radiation is recent. The U. S. Advisory Committee on X-Ray and Radium Protection in 1929 initiated recommended standards for radiation protection. The standards developed, expanded, and revised subsequently, served as the basis for federal legislation in conjunction with the Atomic Energy program of the 1940's. State legislatures and public health authorities also, responding to the same needs felt on the federal level, have greatly increased the radiation protection role of state and local governments within the past decade. Amendments to the U. S. Atomic Energy Act in 1959, permitting states to assume certain regulatory functions administered by the Atomic Energy Commission, have further stimulated state programs. This report is a summary of developments over the past decade in state legislation and regulations affecting radiation protection or control. It also includes tabulations by states of enacted, proposed but not passed, and not completed legislation for the calendar year 1965. (GRA)

34462 (WASH-1332(74)(Vol.1), pp 29-44) AEC RESPONSE TO RECENT DEVELOPMENTS IN NEPA IMPLEMENTATION. Pennington, W. H. (Atomic Energy Commission, Washington, DC). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

Recent developments in implementing the National Environmental Policy Act (NEPA) by the AEC are discussed. It is pointed out that the NEPA is interpreted by implementing agencies, like any other Congressional Act, until the courts hand down decisions for further interpretation, and several hundred court cases involving NEPA have been decided to date. The decision in the case of Natural Resources Defense Council (NRDC) versus Morton is reviewed in relationship to the current implementation of NEPA in the area of the preparation of environmental impact statements relevant to AEC operations. The decision in this case stated that not only alternative treatments but the alternative of taking no action must be considered. An example cited as the result of this decision is the environmental impact statement prepared by the Department of Interior relevant to the construction of the trans-Alaska pipeline which resulted in an eight-inch-thick volume and considered every available alternative for bringing this oil to the consumers. The decisions in several other court cases involving NEPA that are relevant to the preparation of environmental impact statements for AEC operations are also discussed briefly. A list is included of all environmental impact statements for AEC operations prepared to date or in preparation and publications for guidance in the preparation of environmental impact statements. (CH)

34463 LAW AND LOW-LEVEL RADIATION. Eason, C. F.; St. Denis, N. Y. (Atomic Energy Commission, Washington, DC). Nucl. Safety; 15: No. 5, 585-592(1974).

A number of latent-radiation-injury cases were examined with particular emphasis on the kinds of radiation records offered in evidence, the nature of the expert testimony by both the health physicist and the medical expert, and the conclusions of the court or board in the final adjudication of the claim. The views of those who hold that the present legal system in the United States is not appropriate for the handling of latent-injury claims are explored. (auth)

34464 NEW X-RAY DECREE. Bischof, W. (Univ., Gottingen, Ger.). Neue Juristische Wochenschr.; 26: No. 32, 1402-1405(1973). (In German).

The x-ray decree of March 1, 1973 is the first comprehensive legal regulation for the use of x rays in the FRG, i.e. it regulates the use of x-ray devices not only in human and veterinary medicine but also in the natural sciences and in industrial and technical fields. The recommendations of the ICRP and of the ICRU are taken here into account. The field of application of the decree is determined by a minimum (3 MeV) and a maximum (5 KeV) limit value of x-ray energy. All x-ray equipment and radiation emitters falling within these limits will undergo a federal control from the effective day (1/9/73) onwards. The decree gives a very detailed legal regulation as regards the use of x-rays for the examination of living persons. (GE)

34465 IONIZING RADIATIONS. pp 1164-1262 of Conditions de Travail. Lois et Textes Reglementaires. Pluyette, J. Paris; Technique et Documentation (1973). (In French).

Under the legislation in force concerning the prevention of occupational diseases have been assembled the texts taken from the official gazette on the protection of workers exposed to ionizing radiations. (FR)

Management

Refer also to abstracts 31913 and 32018.

34466 (DEU-73-16) STEAG BUSINESS REPORT ON THE 35th YEAR IN BUSINESS 71/72. (Steinkohlen-Elektrizitaet A. G. (STEAG), Essen (F. R. Germany)). 1973. 71p. (In German).

The business report contains among others a section on the STEAG activities regarding the fuel supply for nuclear power plants (on the participation in the Uranium Society m.b.H.), the enrichment by separation nozzles (together with the Nuclear Research Centre Karlsruhe), the fuel element production (in connection with Westinghouse Electric Corp.), as well as the reprocessing (together with Eurochem/Mol and the Societe de Fluoration de l'Uranium). (GE)

34467 (KFK-1950) REPORT ON RESEARCH AND DEVELOPMENT WORK IN THE YEAR 1973. (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (F. R. Germany)). Feb 1974. 312p. (In German). INIS.

With figs.; tabs. and refs.

Annual reports of the various institutes and departments of the Gesellschaft fuer Kernforschung (GfK), summarizing the research and development work of the year 1973 are given. (GE)

34468 (NRPB-R-15) NRPB INTERIM RADIATION DOSE RECORD SERVICE. Greenslade, E. (National Radiological Protection Board, Harwell (UK)). Dec 1973. 18p. Dep. NTIS (US Sales Only) $4.00 UK 50 pence.

A national Radiation Dose Record Service was initiated in the United Kingdom by the National Radiation Protection Board on 1 April 1973. It is of an interim character pending the development of a fully automated system of personal dosimetry with continuous dose record keeping. The service utilizes the Harwell IBM System 370 Computer, by arrangement with the AERE Personal Monitoring Service, and it meets the requirements of the relevant UK Codes of Practice and Regulations. It does not relieve employers of their responsibility for keeping dose records but it does provide them with all the necessary record information in an approved form. The scope of the service and the operating procedures are described and comments are made on experience gained to date. (auth)

34469 (PTB-L-1) PUBLICATIONS OF THE PHYSIKALISCH-TECHNISCHE BUNDESANSTALT, COMPILED BY REFERAT SCHRIFTTUM. (Physikalisch-Technische Bundesanstalt, Berlin (F. R. Germany)). Apr 1974. 20p. (In German). INIS.

This literature compilation gives a review of publications published by the PTB and a list of PTB-reports published to date, arranged by series. (GE)

34470 (WASH-1332(74)(Vol.1), pp 19-28) AEC-EPA-STATE RELATIONSHIPS IN ENVIRONMENTAL PROTECTION MATTERS. Schoen, A. (Atomic Energy Commission, Washington, DC). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

Responsibilities for evaluating, implementing, or examining the requirements for environmental protection and pollution control that are imposed on the operation of AEC facilities either by the Environmental Protection Agency (EPA), by state and local pollution control agencies, or by the AEC are discussed. The requirements that AEC facilities and other Federal facilities must meet and implement in the day-to-day operation, design, construction, and maintenance of facilities and programs are reviewed. It is pointed out that the Clean Air Act Amendments (enacted in 1970)

and the Federal Water Pollution Control Act Amendments (enacted in 1972) assign substantial standards-making responsibilities and authorities and enforcement authorities to the EPA and to the states. The amendments to both Acts gave the states the primary authority for establishing emission and effluent standards for air and water pollution control, based on criteria and guidelines to be issued by the EPA. The amendments also specify the dates for establishing the standards and for achieving compliance with them. (CH)

34471 (WASH-1332(74)(Vol.2), pp 693-698) SELECTING CRITERIA FOR DISPOSITION OF CONTAMINATED REAL PROPERTY. Allen, R. E. (Atomic Energy Commission, Washington, DC). Jul 1974.

From 2nd AEC environmental protection conference; Albuquerque, New Mexico, USA (16 Apr 1974).

In proceedings of the second AEC environmental protection conference.

The five modes for disposition of contaminated AEC real property, including buildings and materials, and basic requirements for placing such property in a safe condition are discussed. From a safety viewpoint, the various modes of disposition for nuclear facilities are: standby, closedown, dismantling, entombment, and excess disposal. (CH)

Mathematics and Computers

Refer also to abstracts 32047, 32610, 32616, 32645, and 34460.

34472 (CERN-74-16) INTRODUCTION TO RELIABILITY THEORY. Schorr, B. (European Organization for Nuclear Research, Geneva (Switzerland)). 28 Aug 1974. 81p.

Lecture notes are given of a series of introductory lectures on reliability given at CERN in the Spring of 1974. It covers unrepairable and repairable systems. In addition, some optimization problems are discussed. Two major examples one from the airplane industry, the other from the computer industry, illustrate the theory. Basic concepts of probability and statistics are summarized and are intended for use with design and/or maintenance of complex systems. (auth)

34473 (CONF-740531-) PROCEEDINGS OF FOURTH SYMPOSIUM ON SHARING OF COMPUTER PROGRAMS AND TECHNOLOGY IN NUCLEAR MEDICINE, OAK RIDGE, TENNESSEE, MAY 8–10, 1974. McClain, W. J.; Maskewitz, B. F. (comps.). (Oak Ridge National Lab., Tenn. (USA)). 1974. 207p. Dep. NTIS $7.60.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

Separate abstracts were prepared for the 22 papers presented at this symposium. (CH)

For abstracts of individual papers see: 34474–34495.

34474 (CONF-740531-, pp 1-5) HIGH SPEED INDEXING OF PATIENT REPORT DATA USING THE NUCLEAR MEDICINE COMPUTER. Lieberman, D. E. (Univ. of Michigan, Ann Arbor); Moses, D. C.; Miller, P. A.; Strange, D. R.; O'Neill, W. J. 1974.

From 4th symposium on sharing of computer programs and Technology in Nuclear Medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

A program, INVT, was developed to maintain a dynamic library of coded information concerning patient studies. This program operates within the 16K core of the Nuclear Medicine computer and can be utilized simultaneously with data acquisition by the gamma camera. One disk can store information from 32000 patient studies and a multiparameter search of the entire disk can be performed in 40 seconds. The program is utilized to augment the efficiency of retrieval of patient study information both for improvement of patient care and for teaching. (auth)

34475 (CONF-740531-, pp 6-17) NUCLEAR MEDICINE PATIENT DATA REPORTING SYSTEM UTILIZING AN ON-SITE MINICOMPUTER. Anger, R. T. Jr.; Lieberman, D.; Wellman, H. N. (Indiana Univ. Medical Center, Indianapolis). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

A prototype system for generating patient data records has been designed for use with the Medical Data Systems (MDS) minicomputer system. The reporting system software, LEXICON, provides an interactive and simple method of writing patient records, using text information previously stored in the computer. The executive routine of LEXICON permits the eliciting of subroutines which permit entry and editing of statements, entering of variable data, and the retrieval of existing patient records for report purposes. A specially designed push button terminal permits the physician to form a patient record from a hierarchical array of as many as 16 libraries, each containing as many as 16 selectable statements into which variable data may be entered. Long-term storage of individual records indexed by patient name or identification number or the immediate generation of hard copy patient records is possible. (auth)

34476 (CONF-740531-, pp 18-31) COMPUTER-AIDED NUCLEAR MEDICINE REPORT GENERATION AT VANDERBILT. Price, R. R. (Vanderbilt Univ. Hospital, Nashville); Johannes, J. D.; Lutin, C. D.; Krolak, P. D.; Brill, A. B. 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

A computer-assisted system for generating reports of routine clinical nuclear medicine tests was implemented. The system utilizes a fixed format lexicon of descriptive statements presented via high speed visual terminals. The system has not resulted in an appreciable savings in time to the physician. A revised lexicon is being investigated as a possible solution to this problem. Future plans include the implementation and evaluation of the use of mark-sense coding forms for routine reports generation. New specially designed computer terminals utilizing tactile and voice input are suggested as a possible solution to the reporting problem. (auth)

34477 (CONF-740531-, pp 32-41) COMPUTER ANALYSIS OF CEPHALOANGIOSCINTIGRAPHY DATA. McLaughlin, W. R.; Price, D. D.; Butler, T. (Santa Clara Valley Medical Center, San Jose, CA). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

In an effort to reduce the variability and increase the accuracy of the qualitative data obtained from the γ scintillation camera, a mini-computer was used to process information obtained during the dynamic perfusion of ^{99m}Tc injected intravenously in patients referred for routine brain scintigraphy (brain scan). The paired bilateral regions of interest are selected over the carotid, middle, and anterior cerebral arteries. Time function curves are generated for each region of interest and analyzed for the injection to arrival times, arterial phase and venous phase. Ratios of the smallest over the largest of the total counts in the paired time segments are calculated for each of the regions of interest. A total of 158 cases were studied; and the normal ranges for those in the age range of 40 to 60 years with confirmed follow-up are presented. The preliminary work validates the work of other investigators and suggests that this is a clinically useful procedure and a positive aid to diagnosis. Based on this initial work, further refinement of the technique is currently being undertaken in an effort to automate the procedure and make it more feasible to clinical nuclear medicine. (auth)

34478 (CONF-740531-, pp 42-50) UPDATE ON COMPUTER PROCESSING OF CAROTID AND MAJOR CEREBRAL BLOOD FLOW. Colvin, J. T. (St. Joseph Mercy Hospital, Ann Arbor, MI). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

Preliminary data on the application of the computer analysis for scintigraphic studies of cerebral blood flow using radionuclide tracers suggests that it is a clinically useful procedure and a positive aid to diagnosis. Additional experience with this application of data analysis will establish normal ranges for various age group categories and disease states. Technician time required to do the computer processing is 20 minutes per case. A more automated technique to reduce the processing time to 10 minutes or less is being developed. (CH)

34479 (CONF-740531-, pp 51-60) AUTOMATED BRAIN BOLUS ANALYSES AND SIGNIFICANCE OF VARIOUS EXTRACTED PARAMETERS. Erickson, J. J.; Brill, A. B.; Patton, D. D.; Williams, H.; Ahuja, S.; Price, R. R. (Vanderbilt Univ. Hospital, Nashville). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

A method for automated computer analysis of anterior view brain blood flow studies is described. The analysis of the ^{99m}Tc flow study is completely automated and requires human intervention only for location of the study on the data tape. The analysis includes location of the head image with determination of the midline and subdivision of each hemisphere into 8 rectangular regions of interest. Several parameters are extracted from the curves obtained for data in each of these regions. Discriminant function analysis is described and suggested as a means for determining the relative significance of the various parameters for discriminating between normal and abnormal studies. Application of the analysis system to a limited patient study is discussed. (auth)

34480 (CONF-740531-, pp 61-74) DIGITAL COMPUTER PROCESSING OF MYOCARDIAL INFARCT SCINTIGRAMS. Stokely, E. M.; Parkey, R. W.; Lewis, S. E.; Bonte, F. J. (Univ. of Texas Health Science Center, Dallas). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

Recent studies demonstrated the utility of ^{99m}Tc stannous pyrophosphate (^{99m}Tc–PYP) as an agent for labelling areas of myocardial infarction. While most of these scintigrams need no processing, some are difficult to read because of ^{99m}Tc–PYP, which is taken up by the overlying rib structure, or because the infarct has a low contrast ratio with respect to the normal myocardium. Two computer processing techniques used to overcome these difficulties include band-reject, recursive, digital filtering to remove the rib structure selectively, and background subtraction and contrast enhancement to improve the visibility of low contrast infarcts. Roughly 37% of the myocardial studies from cardiac patients at Parkland Hospital benefit from background subtraction and contrast enhancement, while about 18% require filtering for removal of the rib structure. (auth)

34481 (CONF-740531-, pp 75-80) ACQUISITION, PROCESSING, AND DISPLAY OF GATED CARDIAC SCINTIGRAMS. Alpert, N. M.; Chesler, D. A.; McKusick, K. A.; Potsaid, M. S.; Pohost, G. M.; Dinsmore, R. A. (Massachusetts General Hospital, Boston). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

An improved method for non-traumatic and essentially non-invasive evaluation of left ventricular (LV) function with ^{99m}Tc-human serum albumin is described. This method combines previously used EKG gating techniques for cardiac blood pool visualization with new computerized acquisition, processing and display techniques. An Anger camera, a small computer, and a physiological synchronizer are used to acquire a sequence of eight scintigrams which span the entire cardiac cycle. Under our present protocol two twenty-minute sequences are obtained, one an LAO (50°) projection, the other an RAO (30°) projection. Subsequently these images are processed on-line with a digital filter to increase definition of the cardiac borders. The eight images are then displayed sequentially on a specially designed electronic monitor to give an impression of the beating heart somewhat analogous to that obtained with invasive contrast angiography. The use of computer acquisition, processing, and display techniques such as these results in greatly improved appreciation of LV wall motion over previously used nuclear methods and provides the opportunity to estimate quantitative parameters such as LV ejection fraction, ejection rate, and LV volume vs time. The non-traumatic nature of these measurements makes it possible to obtain these data with the patient in the resting state and following stress or therapy. (auth)

34482 (CONF-740531-, pp 81-88) FUNCTIONAL IMAGING. Wagner, H. N. Jr.; Natarajan, T. K. (Johns Hopkins Medical Institution, Baltimore). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

The concept of functional imaging, made possible by the use of computers in nuclear medicine, is rapidly achieving acceptance in the field of nuclear medicine and represents one of the most important applications of computers in medical diagnosis and biomedical research. The functional image and its relationship with the conventional and multiple serial images are described. The combination of the computer with devices such as the scintillation camera makes it possible to measure the amount of radioactive tracer in small regions as a function of time, and portray regional function in shades of gray or different colors in a single image. In essence, the concept is that physiological function can be expressed as a mathematical function of the time course of the tracer in different regions, and can be viewed as a single image. Examples cited include lung ventilation studies using ^{133}Xe washout and cerebral blood flow studies using ^{99m}Tc pertechnate. (CH)

34483 (CONF-740531-, pp 89-94) RECENT SOFTWARE DESIGN BASED ON EXPERIENCE IN A NUCLEAR MEDICINE FACILITY. Deveau, L. A.; Correll, J. E. (Massachusetts General Hospital, Boston). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

Since the use of computers in nuclear medicine has gained a wider acceptance it has been imperative to consider their efficient use not only in the area of instrumentation-computer interaction but also in the area of man-computer interaction. Optimization of human involvement with the computer through the use of software techniques such as filenames and directories, codes, operations, and procedures is part of the current system design work at the Physics Research Laboratory of the Massachusetts General Hospital. These techniques are being used to implement many features believed to be important to a well human engineered nuclear medical system. These features include easy to use standard procedures, meaningful data specification, prompting, imperative and default modes, and extensive utility functions. (auth)

34484 (CONF-740531-, pp 95-102) DESIGNING AN ON-LINE COMPUTER CONFIGURATION TO MEET THE NEEDS OF A GROWING NUCLEAR MEDICINE FACILITY. Correll, J. E.; Deveau, L. A.; Alpert, N. M. (Massachusetts General Hospital, Boston). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

As computer applications in nuclear medicine increase, the saturation of present computer facilities becomes a problem. This paper emphasizes establishing a long range plan for phased computer expansion to achieve the most efficient solution. Included are the points to consider when selecting a nuclear medicine on-line computer configuration (reliability; ease of operation; simultaneous acquisition, processing, and display; phased development; software/hardware complexity; adaptability to new technology; and cost-effectiveness) and five basic alternative computer systems along with their advantages and disadvantages. (auth)

34485 (CONF-740531-, pp 103-112) LEAST-SQUARES BI-EXPONENTIAL FITTING ALGORITHM FOR TWO-COMPARTMENT MODELING. Schurr, D. A. (Kaiser-Permanente Medical Center, Oakland, CA). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

The problem of fitting data to a bi-exponential curve arises whenever a two-compartment model of some biological process seems theoretically appropriate. The disappearance of ^{131}I-Hippuran from the vascular system can, for example, be modeled in such a way. The problem has been attacked successfully in various disciplines, yet no simple routine has been readily available for use on small minicomputers. The implementation in FOCAL8 of one well-known solution (the modified Gauss–Newton iterative scheme) with a preprocessor written to help solve the correlative problem of initial parameter estimation is described. Its application to effective renal plasma flow determination using nonrenal ^{131}I Hippuran disappearance data is also presented. (auth)

34486 (CONF-740531-, pp 113-115) TEMPORAL DATA AVERAGING IN DYNAMIC CLINICAL OR EXPERIMENTAL RADIONUCLIDE STUDIES. Flowers, W. M. Jr.; Smith, R. O. (Univ. of Mississippi Medical Center, Jackson). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

A method is described of data averaging in dynamic radionuclide diagnostic studies based on time rather than spatial position. Acquisition of rapid successive frames of changing isotope distributions during a dynamic clinical or experimental radionuclide study usually requires a compromise between frame rate and data density per frame. Averaging successive frames, with or without weighting the central frame, can sometimes allow a given study to proceed at faster frame rates or lower data densities. Each averaged scan is produced from a consecutive set of data frames. Every set of frames overlaps each adjacent set by one frame. Display can be repeated with variable parameters until optimal results are attained. (auth)

34487 (CONF-740531-, pp 116-121) BONE MINERAL DETERMINATION WITH A SCINTILLATION CAMERA–COMPUTER SYSTEM. Thompson, W. L.; DePuey, G.; Alagarsamy, V.; Murphy, P. H.; Burdine, J. A. (Baylor College of Medicine, Houston). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

The method of Cameron for determination of bone mineral content was adapted to a scintillation camera-computer system using a sheet source of ^{241}Am. A functional image of bone mineral content in the os calcis is obtained from which a region of interest for the calculation of an average mineral index is delineated. This procedure has most of the advantages of previously described techniques with the added advantage of being relatively insensitive to the exact positioning of the area to be measured and does not require specialized instrumentation. (auth)

34488 (CONF-740531-, pp 122-127) FREQUENCY DISTRIBUTION OF THE V/Q RATIO. Murphy, P. H.; Alagarsamy, V.; Burdine, J. A. (Baylor College of Medicine, Houston). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

The uncoupling of ventilation and perfusion is probably the most common denominator in all lung dysfunction. To quantitate the degree of mismatch the frequency distribution of the V/Q ratio was studied in upright patients by scintiscanning following administration of radionuclide tracer. The V/Q ratio was calculated for each cell of a 64×64 matrix and the results displayed as a color-coded functional image. A plot of the fractional lung ventilation and perfusion as a function of the V/Q ratio was obtained which can be characterized according to disease and degree of abnormality. (auth)

34489 (CONF-740531-, pp 128-139) THYROID UPTAKE AND IODINE CONTENT VIA COMPUTER. Patton, J. A.; Hollifield, J. H.; Brill, A. B. (Vanderbilt Univ. Hospital, Nashville). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

Computer-aided analysis of thyroid function is performed routinely using the relatively new techniques of 20 minute uptakes with ^{99m}Tc and fluorescence scanning of thyroidal stable iodine (^{127}I) pools. The 20 minute ^{99m}Tc uptake provides a rapid assessment of the trapping mechanism of the thyroid with reduced radiation exposure to the patient. Computer techniques are used to correct for background. The fluorescent thyroid scan provides an image of the stable iodine distribution in the thyroid which yields a measure of the organification and storage properties of the gland. This is new information, and the radiation exposure is small. Preliminary experience in studying patients with nodules suggests that numerical criteria from computer analyzed x-ray fluorescence scans may be helpful in determining which nodules should be operated upon and which can be followed conservatively. These two studies together provide a detailed pictorial and quantitative analysis of thyroid function. The use of the computer in these procedures permits quantitative measurements to be made, regions of interest to be selected and analyzed, and reports to be generated for the studies. The computer is in these studies an integral part of the data acquisition and analysis procedure. (auth)

34490 (CONF-740531-, pp 140-149) COMPUTER-ASSISTED TECHNIQUE FOR QUANTITATIVELY ASSESSING RENAL FUNCTION STATUS IN RENAL TRANSPLANT PATIENTS. Rollo, F. D.; Shames, D. M.; Farmer, R. E. L. (Univ. of California, San Francisco). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

A computer-assisted technique for quantitatively assessing renal function status in renal transplant patients is described. The technique is used in conjunction with ^{131}I-hippurate scintigraphy studies to fully evaluate the renal function status of the renal transplant patient. The scintigraphy study is used mainly to assess morphologic and functional features of the kidney and collecting structures and to rule out the possibility of extravasation or obstruction. The uptake and excretion indices on the other hand quantitatively measure changes in uptake and excretion and provide a unique method of following the course of ATN and rejection. Preliminary results show that the technique is extremely sensitive and reliable and in several cases has been found to be the first measure to demonstrate signs of rejection superimposed on ATN. In addition, excellent correlation has been obtained between these indices and blood laboratory data. (auth)

34491 (CONF-740531-, pp 150-155) PROGRAMMABLE CALCULATORS IN THE IN-VITRO NUCLEAR MEDICINE LABORATORY. Silverstein, E. A.; Holmes, R. A. (Medical Coll. of Wisconsin, Milwaukee). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

Programmable calculators have been found a useful adjunct to the in-vitro radionuclide tracer laboratory. Older units such as the Programma 101 are not obsolete and still retain their usefulness for many routine studies. This is particularly true in an expanding laboratory where their ready availability satisfies ever expanding immediate needs. It is also clear that greater amounts of calculating power and other capabilities are becoming available at continually lower prices. Thus, even though it was concluded that a fairly expensive programmable calculator was needed to fill the needs of the in-vitro laboratory, this may not be so in the future. (auth)

34492 (CONF-740531-, pp 156-165) IMPROVING DIFFERENTIAL NON-LINEARITY WHEN DIGITIZING SCINTILLATION CAMERA OUTPUT. Smith, R. O.; Flowers, W. M. Jr.; Lehan, P. H.; Hellems, H. K. (Mississippi Medical Center, Jackson). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

Some error will be unavoidable when converting γ camera position pulses obtained during radionuclide scintiscanning to a form suitable for digital computer input. A hybrid design was employed for speed and transistor changes were made for higher gain in the comparators. In this way, modules that were obtained off the shelf were used in a design with <1% differential nonlinearity of the normalized single level increments when 9.5 μs was allowed for conversion of each event. The error increased to from 3 to 6% when only 5.1 μs was allowed for converting each event. (auth)

34493 (CONF-740531-, pp 166-179) SYSTEMS APPROACH TO THE IMPLEMENTATION OF A DYNAMIC RADIONUCLIDE PHANTOM FOR EVALUATION OF THE HIGH COUNT RATE PERFORMANCE OF CAMERA/COMPUTER DEVICES. Kirch, D. L.; LeFree, M. T.; Trow, R. S.; Steele, P. P.; Brown, D. W. (Denver Veterans Administration Hospital). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

Current interest in the high count rate dynamic performance of scintillation imaging devices is running high. Since most of these devices are presently of the Anger camera type, they exhibit deadtime losses normally associated with serial discrete processes. Furthermore, these dynamic imaging devices are commonly interfaced to a dedicated digital computer and the serial nature of the camera/computer interface creates another distorting influence on the scintillation image data. No one can deny the existence of data losses at count rates above 50,000 cps. There is, however, little agreement on the proper mathematic models and methods for correction of data which has been distorted by these effects. The construction and use of a simple phantom device is described which will permit the quantitation and intercompari-

son dynamic computer/camera system performance. This device gives insight into the nature of dynamic data distortion. (auth)

34494 (CONF-740531-, pp 180-193) COMPUTER ASSISTED TECHNIQUE FOR EVALUATING THE PERFORMANCE OF SCINTILLATION CAMERAS. Rollo, F. D.; Farmer, R. E. L.; Shames, D. M. (Univ. of California, San Francisco). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

A computer assisted technique was developed to evaluate the performance of γ scintillation camera systems. The technique involves the use of a performance index which includes the system's spatial resolution, in terms of the contrast efficiency function, and plane sensitivity as measured by statistical fluctuation. The index has special merit in that it measures how well a given system will reproduce a specific input problem in the image plane. Therefore, when used to compare the performance of various imaging systems or to study the effect of varying a parameter within a given system, all comparisons are made on the basis of how well the imaging systems in question are able to reproduce an object having specific geometry in the image plane, for equal times of observation. The performance index calculation requires that line spread function measurements be made for the imaging system and radioisotope of interest. Such measurements are particularly time consuming for static imaging devices. Therefore, to facilitate such measurements, a computer assisted technique was developed which quickly and accurately determines the line spread function data for scintigraphy systems. The theory of the performance index concept, the method of determining line spread function data, and the overall computer technique used to evaluate scintillation camera performance are described. An example application of the method is also presented. (auth)

34495 (CONF-740531-, pp 194-201) CALCULATION OF ISODOSE CURVES AROUND INTERSTITIAL AND INTRACAVITARY RADIATION SOURCES. Flowers, W. M. Jr.; Morris, J. O. (Univ. of Mississippi Medical Center, Jackson). 1974.

From 4th symposium on sharing of computer programs and technology in nuclear medicine; Oak Ridge, Tennessee, USA (8 May 1974).

In proceedings of fourth symposium on sharing of computer programs and technology in nuclear medicine.

RADCOMP II is a powerful, general purpose computer program designed for dosimetry for interstitial and intracavitary radiation therapy of neoplasms. It will produce detailed drawings of the isodose levels around radioactive sources. The purpose of this paper is to describe a translation of RADCOMP II suitable for execution on the IBM 360 or 370 system. Comprehensive, automated dosimetry is available without serious restrictions on the types or locations of sources. Calculation planes may lie at any angle to the sources, and at any angle to each other; they may intersect the sources or lie at any distance from them. (auth)

34496 (JAERI-M-5596) GCRVFIT: AN INTERACTIVE LEAST SQUARES CURVE FITTING SYSTEM BY ORTHOGONAL POLYNOMIALS. Nakamura, Y.; Onuma, Y.; Kobayashi, K.; Suzuki, T. (Japan Atomic Energy Research Inst., Tokyo). Mar 1974. 33p. (In Japanese). NTIS (US Sales Only).

The interactive curve fitting system GCRVFIT, which uses graphic display, has been developed for both FACOM 230-35 and FACOM 230-60 computers. In this system, raw data given by a user are approximated by using orthogonal polynomials by the method of least squares. After numerical calculation, the raw data and calculated function values are automatically scaled, and the graphs of these data and values are displayed on the CRT. By seeing the graphs on the CRT, the user can intuitively understand whether the result of curve fitting is satisfactory or not. If the result is not satisfactory, the user can modify the degree of orthogonal polynomial directly from the alphanumeric keyboard, and can immediately reexecute the curve fitting. Moreover, constraints or weights or other data can be modified from a card reader. (auth)

34497 (JAERI-M-5597) GLP 1: AN INTERACTIVE CURVE FITTING SYSTEM BY LINEAR PROGRAMMING. Nakamura, Y.; Suzuki, T.; Kobayashi, K.; Onuma, Y. (Japan Atomic Energy Research Inst., Tokyo). Mar 1974. 37p. (In Japanese). NTIS (US Sales Only).

The interactive curve fitting system GLP1, which uses graphic display, has been developed for both computers of FACOM 230-35 and FACOM 230-60. In this system, raw data given by a user are functionally approximated in L_1 norm or L_∞ norm by linear programming. After numerical calculation, the raw data and calculated function values are automatically scaled, and the graphs of these data and values are displayed on the CRT. By seeing the graphs on the CRT, the user can intuitively understand whether the result of curve fitting is satisfactory or not. If the result is not satisfactory, the user can change the norm from L_1 to L_∞ or from L_∞ to L_1, by lightpen, and immediately reexecute the curve fitting. Moreover, approximating functions or auxiliary conditions or other data can be modified from a card reader. (auth)

34498 (KFK-1979) SIMULATION OF QUEUEING SYSTEMS: A PROGRAMMING SYSTEM FOR SAMPLING AND EVALUATION OF DATA. Drobnik, O.; Schumacher, F.; Senger, R. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Datenverarbeitung in der Technik). Jul 1974. 90p. (In German). Dep. NTIS (U. S. Sales Only) $7.50.

Simulation is often used to compare alternative strategies in stochastic queueing systems. Problems arise as well from the necessity to transform raw data gained by simulation into samples matching the requirements of statistical decision procedures. The report presents a description of statistical evaluation methods and their implementation in the language SIMULA. (tr-auth)

34499 (LA-5713-MS) NUMERICAL SOLUTION OF THE FLOW STRUCTURE IN TORNADO-LIKE VORTICES. Stein, L. R.; Harlow, F. H. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1974. Contract W-7405-eng-36. 5p. Dep. NTIS $4.00.

A numerical method is described for the solution of the full Navier-Stokes equations in cylindrical coordinates with azimuthal symmetry, particularly for fluid flow circumstances like those used in the laboratory for the simulation of tornado-like vortices. Only the computer technique is described here. (auth)

34500 (MC-18-1974) FORTRAN SUBROUTINE FOR NUMERICAL INTEGRATION. Rizea, M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 15p. (In Rumanian). Dep. NTIS (US Sales Only) $4.00.

A subroutine for numerical integration is presented. The accuracy of the computation is controlled by using an algorithm that seeks the best division of the integration interval so that on the subintervals the desired accuracy is achieved. The algorithm isolates the critical points of the function to be integrated. (tr-auth)

34501 (MRR-134) CHARACTERISTIC STATISTICAL FUNCTIONS AND PARAMETERS OF MULTIPLE INPUT/OUTPUT SYSTEMS (TUMX68). Saedtler, E. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Feb 1974. 36p. (In German). INIS.

7 refs. With abstract in German and English.

The theoretical foundations for the digital computation of characteristic statistical functions and parameters of a multiple input/output system are described. A short summary of estimation methods for spectral density functions of large time sequences is presented. For some characteristic functions the estimated confidence limits and intervals are specified. (auth)

34502 (ORO-3443-50) CONNECTION BETWEEN THE FINITE DIFFERENCE LIKE METHODS AND THE METHODS BASED ON INITIAL VALUE PROBLEMS FOR ODE. Babuska, I. (Maryland Univ., College Park (USA). Inst. for Fluid Dynamics and Applied Mathematics). Jul 1974. Contract AT(40-1)-3443. 30p. (CONF-740627-2; BN-796;). Dep. NTIS $4.50.

From conference on numerical solution of B. V. P. for O. D. E.; College Park, Maryland, USA (10 Jun 1974).

It is shown that there are no large differences between two main groups of methods for solving boundary value problems. One group includes finite difference, finite element, and related methods. The second method is the approach that transforms the boundary value problem into a sequence of initial value problems for ODE (or partial differential equations) such as the shooting method, methods based on invariant bedding techniques, techniques variously called factorization, simple factorization, method of sweeps, or chasing, or methods of continuous factorization, and others. (MCW)

34503 (P.A.U. M-26) DISCUSSION OF SOME METHODS FOR THE COMPARATIVE EVALUATION OF A SET OF PROJECTS. Inston, H. H.; Llewelyn, G. I. W. (Programmes Analysis Unit, Chilton (UK)). Jul 1974. 47p. Dep. NTIS (US Sales only) $5.50. £1.

An inspection of some theoretical methods for their suitability as rapid procedures for ranking portfolios of R & D projects indicated that the idea of merely ranking a set is unsuitable if it conceals information generated in assigning the rankings. The relevance tree method, scoring method, and cross-impact matrices are methods applied to complex problems with many components, possibly poorly defined. The Lagrange multipliers are applied to

well-defined problems involving a set of projects with reliable descriptive data. The SORK method, a method for sorting a set of quantified comparative evaluations, is applied to well-defined problems but with recourse only to subjective data. (MOW)

34504 (RT/EDP-(74)1) BRIEF SYSTEM FOR THE COMPOSITION AND REPRODUCTION OF TEXTS. Maioli, C.; Valentini, M. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Feb 1974. 16p. (In Italian). Dep. NTIS (U. S. Sales Only) $4.00.

BRIEF is a conversative system to edit, reproduce, catalog, and modify texts, documents, and letters. No experience in programming is required for its use. The system is available under TSO of OS 360/370 IBM. (tr-auth)

34505 (RT/EDP-(74)2) PLOTTING AND COMPENSATION OF ROOT LOCUS BY A DIGITAL COMPUTER. Bernabei, R.; Ferri, S. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Feb 1974. 74p. (In Italian). Dep. NTIS (US Sales Only) $6.75.

34506 (RT/EDP-(74)4) FACET SYSTEM FOR THE TEACHING OF DATA PREPARATION. Maioli, C.; Valentini, M. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Feb 1974. 39p. (In Italian). Dep. NTIS (US Sales Only) $5.00.

A description of a system available on IBM 360/75 at CNEN Computer Center is given. It permits a complete insight into machine-language programming. (tr-auth)

34507 (SAND-74-0216) JOHN von NEUMANN'S 1944 CONJECTURES ON WAVECODE CONVERGENCE, A PROGRESS REPORT (1944–1974). Hicks, D. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). Aug 1974. Contract AT(29-1)789. 13p. Dep. NTIS $4.00.

In the 1944 report "Proposal and Analysis of a New Numerical Method for the Treatment of Hydrodynamical Shock Problems" John von Neumann proposed a computation scheme for flows including shock waves. He conjectured that his method would produce a convergent sequence of approximations and said: "A mathematical proof of this surmise would be most important, but it seems to be very difficult even in the simplest special cases." The names "wavecode," "hydrocode," "flowcode," etc., are now used to describe the type of program proposed by von Neumann. That is, a computer program designed to produce the numerical solutions to a discrete approximation of the equations governing wave propagation. Convergence was considered most important perhaps because of the relationship the convergence questions has with the wavecodes accurately predicting the motion of a material. Predictions may be made for the weather; how rain erodes the Earth and other surfaces; how a blast wave propagates through the atmosphere; how pollution will spread in the atmosphere, river, or ocean; how an automobile will bend in a collision; how earthquake- or bomb-induced pulses will travel through the Earth; how large waves will propagate over the ocean; or how plasma will flow when an attempt is made to contain it to attain controlled fusion. Wavecodes can produce predictions to the answers to these problems. (auth)

34508 (SLA-74-0339) AMOSLIB: A SPECIAL FUNCTION LIBRARY. Amos, D. E.; Daniel, S. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). Aug 1974. Contract AT(29-1)-789. 50p. Dep. NTIS $5.50.

One-page descriptions are presented of a variety of special function codes. The description includes the function definition, the FORTRAN call, parameter definitions, and a list of subroutines used by each code. (auth)

34509 (SLA-74-5263) INTERPOLATING NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS. Gordon, M. K.; Shampine, L. F. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 6p. (CONF-741101-2). Dep. NTIS $4.00.

From ACM annual conference; San Diego, California, USA (11 Nov 1974).

Methods like the Runge-Kutta family for the solution of ordinary differential equations produce approximate solutions only at mesh points. The efficiency of such methods is greatly reduced if the user requests output too frequently. Justification for interpolating to resolve this difficulty is discussed. In addition the use of interpolation to approximate the derivatives of the solution is justified. (auth)

34510 (UCID-30050(Pt.2)) CONSTRUCTION OF MATHEMATICAL SOFTWARE. Part II. Some Examples of Mathematical Software. von Holdt, R. E.; Dickinson, R. P. Jr.; Pexton, R. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Dec 1972. Contract W-7405-eng-48. 30p. Dep. NTIS $4.50.

This is Part II of a five-part report on the construction of mathematical software. Chapter 1 discusses software for the elementary functions, while Chapter 2 is concerned with input/output number conversion. Chapter 3 is a brief description of EISPACK, a package of subroutines to solve the algebraic eigenvalue problem. Software for calculating Padé approximants, based on the work of I. M. Longman, is described in Chapter 4. (auth)

34511 (UCRL-50023-74) COMPUTATION DEPARTMENT ANNUAL REPORT, JULY 1973 TO JUNE 1974. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Sep 1974. Contract W-7405-eng-48. 25p. Dep. NTIS $4.00.

The Computational Department at LLL is described and its duties are to provide for the computational needs of the Laboratory by computer programming and mathematical support and to provide for research in computer science and planning or progress. The hardware system is described that includes four CDC 7600's and two CDC 6600's, four large storage systems, dozens of lesser storage devices, 150 small computers, over 700 terminals, over 100 television output monitors, and other peripheral devices. Development of the software for 1974 is summarized. (MCW)

34512 (UCRL-51622) S3F-SYR/LLL1: THE SYRACUSE COMPUTER CODE FOR RADIATION AND SCATTERING FROM BODIES OF REVOLUTION, EXTENDED FOR NEAR-FIELD COMPUTATIONS. Bevensee, R. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 May 1974. Contract W-7405-eng-48. 104p. Dep. NTIS $5.45.

The Syracuse University code of R. F. Harrington and J. R. Mautz which treats electromagnetic radiation and scattering from bodies of revolution, both loaded and unloaded, is extended to include capability for near-field computations at selected test points. The method of moments applied to the integral equation for scattered field $\underline{E}^{sc}$ is utilized to construct the measurement matrix $\underline{Z}_M$, which determines a network matrix $\underline{V}^{sc}$ of the scattered field by the matrix equation $\underline{V}^{sc} = \underline{Z}_M \cdot \underline{I}$, $\underline{I}$ being the surface current matrix. The incident field is measured by subroutine PLANE as before, but with the test segment as the field segment. Part A of the original Syracuse code (S3F-SYR) is made a subroutine of each of the modified parts B, C, and D. Part B treats scattering of axially incident plane waves, C treats radiation from bodies of revolution excited by rotationally symmetric tangential E-field on rotationally symmetric apertures, while part D treats backscattering of obliquely incident plane waves. The code remains valid for solid bodies, bodies not intersecting the axis of revolution (i.e., toroids), zero-thickness conductors, and bodies with points and edges. Representative computations are given for fields tested on the surface of a cone-sphere, and discrepancies between applied and computed fields on perfectly conducting surfaces and in gaps with exciting E-field are discussed. (auth)

34513 SOFTWARE SUMMARY FOR DESCRIBING COMPUTER PROGRAMS AND AUTOMATED DATA SYSTEMS. Federal Information Processing Standards Publication 30. Washington, DC; National Bureau of Standards (1974). 4p. (ICONS-01812). GPO $0.20.

A standard software summary form (SF-185) together with instructions for describing computer programs and/or automated data systems for identification, reference, and dissemination purposes is provided. Federal Information Processing Standard Software Summary Form (SF-185) will be used in documenting summaries or abstracts of programs and/or automated data systems that are developed or acquired by federal departments and agencies. This form will also be used by the General Services Administration in the establishment of a centralized registry of selected government software. (auth)

Miscellaneous

34514 (CONF-731141-(Absts.)) THIRD CONFERENCE ON EMBRYONIC AND FETAL ANTIGENS IN CANCER, NOVEMBER 4–7, 1973, KNOXVILLE, TENNESSEE. Anderson, N. G.; Coggin, J. H. Jr.; Cole, E. B. (eds.). (Oak Ridge National Lab., Tenn. (USA)). 1973. 48p. Dep. NTIS $4.00.

Abstracts are presented for 72 papers presented at this conference that cover molecular aspects of gene regulation and carcinogenesis; cross-reactive antigens; cancer, pregnancy, and evolution; carcinoembryonic antigen; fetal proteins; ectopic synthesis and host response; and related topics. (CH)

34515 (ITEF-70) NUMERICAL METHOD FOR CALCULATION OF SHELLS FORMED IN A NON-HETEROGENOUS MEDIUM HIGH-TEMPERATURE GASES WITH CONSTANT PRESSURE. Dobrolyubov, L. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 27p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

A finite difference method for calculation of the motion of shells formed in nonhomogeneous medium by high temperature

gases is reported. Questions on the stability of the finite difference analogs of the problems were studied. (tr-auth)

34516 (ORNL-EIS-73-60(Vol.1)(No.6)) NSF-RANN TRACE CONTAMINANTS ABSTRACTS. Yearly Review Issue. Copenhaver, E. D. (Ed.). (Oak Ridge National Lab., Tenn. (USA)). Jul 1974. Contract W-7405-eng-26. 169p. Dep. NTIS $11.50.

The abstracts were originated to facilitate and enhance the exchange of data among the grantees of NSF/RANN's Trace Contaminants Program and to provide interim progress information to persons and organizations outside the family of grantees. Abstracts 1 through 324 are presented in this annual issue and represent all the research results published to date by grantees of the NSF-RANN Environmental Aspects of Trace Contaminants Program. (MCW)

34517 (ORNL-EIS-74-60(Vol. 2)(No. 1)) NSF-RANN TRACE CONTAMINANTS ABSTRACTS. Second Annual Conference Issue. Copenhaver, E. D. (ed.). (Oak Ridge National Lab., Tenn. (USA)). Aug 1974. Contract W-7405-eng-26. 55p. Dep. NTIS $5.75.

The Second Annual Conference Issue is a compilation of 83 abstracts of research performed by the grantees of NSF-RANN Environmental Aspects of Trace Contaminants Program. The agenda of the second annual conference on August 28, 1974, is outlined. (MCW)

34518 (RFP-2245) PROPAGATION OF ERROR PROCEDURE FOR GENERAL QUADRATIC CALIBRATION CURVES. Ferris, Y. M. (Dow Chemical U.S.A., Golden, Colo. Rocky Flats Div.). 13 Sep 1974. Contract AT(29-1)-1106. 6p. Dep. NTIS $4.00.

Establishing a calibration curve consists of determining a mathematical relation between a known quantity and a measured response. When solved in reverse, such a mathematical function becomes the calibration curve. If the calibration line is the solution of a straight line, the standard deviation of a quantity determined from the function can be easily obtained. If the calibration line is the solution of a quadratic, propagating the errors associated with a quantity determined from the line becomes a difficult and error-prone algebraic exercise. The problems become more troublesome, if the increments of calibration are not equal. Given is a procedure for calculating the standard deviation of a quantity determined from the least squares fit of a quadratic equation solved in reverse. (auth)

34519 (UCRL-51336-74) SECOND ANNUAL REPORT, DOT-CIAP PROGRAM. MacCracken, M. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Jul 1974. Contract W-7405-eng-48. 172p. Dep. NTIS $7.60.

The Department of Transportation (DOT), through its Climatic Impact Assessment Program (CIAP), is seeking to determine the effects on global climate that would result from large numbers of aircraft operating in the stratosphere. The results of these studies will be published in a series of monographs in 1974. As a contributor to this program, Lawrence Livermore Laboratory (LLL) has undertaken a number of studies emphasizing numerical model development and application. Activities for the past year and projections for the next year are summarized. Each of the numerical models is discussed, and LLL participation in preparing input for the monographs is described. (auth)

Chemistry

34520 (IEA-320) NEUTRON TRANSMISSION STUDY OF THE ROTATIONAL FREEDOM OF METHYL GROUPS IN POLYDIMETHYLSILOXANE. Amaral, L. Q.; Vinhas, L. A.; Herdade, S. B. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Dec 1973. 22p. Dep. NTIS (US Sales Only) $4.25.

The total neutron cross section of polydimethylsiloxane has been measured as a function of neutron wavelength in the range 4Å to 10Å, at room temperature, using a slow-neutron chopper and time-of-flight spectrometer. Scattering cross sections per hydrogen atom were obtained and the slope (12.2 ± 0,2) barns/Å has been derived. Comparison with calculated neutron cross sections using the Krieger-Nelkin formalism for different dynamical situations as well as comparison with calfbration curves relating the slope to the barrier hindering internal rotation indicates the existence of practically free rotation of CH_3 groups about their C_3 axis. (auth)

34521 (JEN-285) ISOLATION OF DEOXYRIBONUCLEIC ACIDS (A REVIEW). de Garcia Pineda, M. (Junta de Energia Nuclear, Madrid (Spain)). 1974. 62p. (In Spanish). Dep. NTIS (U. S. Sales Only) $6.25.

The criteria of choice in this review have been to gather some of the latest advances in the methodology of DNAs isolation; also the description of the generally accepted procedures has been emphasized. Only papers published before March 1974 are reviewed, because this work was finished during this month. (auth)

34522 (SLA-74-0233) CHEMICAL VAPOR DEPOSITION OF CARBON: KINETIC PROCESSES IN METHANE PYROLYSIS. Lieberman, M. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jun 1974. Contract AT(29-1)-789. 48p. Dep. NTIS $5.50.

Kinetic factors affecting methane pyrolysis in a closed system were experimentally investigated. Mass of deposit, total gas pressure, and gas composition were measured as functions of reaction time, substrate temperature (1040–1477°C), and initial methane pressure (50–500 torr). It is shown that for the chemical vapor deposition of carbon from methane the mass of deposit is linearly related to the increase in total gas pressure, although the production of gaseous molecules greatly exceeds the amount predicted from the overall reaction $CH_4 \rightarrow C + H_2$. This is attributed to gaseous reactions that do not deposit carbon. Variations in the apparent activation energy of deposition suggest that the process is complex and multiply activated. Gas analyses show the formation of a variety of different species and the time dependencies of their concentrations permit speculation as to the specific chemical reactions occurring during pyrolysis. (auth)

34523 (UCID-15902) DETERMINATION OF FATTY ACIDS AND THEIR METHYL ESTERS IN MERGINAMIDE L-425. Bissell, E. R.; Fields, D. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Sep 1971. Contract W-7405-eng-48. 6p. Dep. NTIS $4.00.

A gas chromatographic method was developed for the determination of fatty acids and their methyl esters in the complex amino amide Merginamide L-425. In the method the chromatography is done after the fatty acids have been converted to their methyl esters. Results are given for the analysis of Merginamide L-425 and its predecessor soya bean oils (Comerginates). (auth)

Life Sciences

34524 (CEA-R-4601) STATISTICAL PROBLEMS RAISED BY DATA PROCESSING OF FOOD SURVEYS. Lacourly, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Aug 1974. 256p. (In French). Dep. NTIS (US Sales Only) $16.00.

Thesis. Submitted to Faculte des Sciences de Paris.

The methods used for the analysis of dietary habits of national populations–food surveys–have been studied. S. Lederman's linear model for the estimation of the average individual consumptions from the total family diets was in the light of a food survey carried on with 250 Roman families in 1969. An important bias in the estimates thus obtained was shown by a simulation assuming "housewive's dictatorship"; these assumptions should contribute to set up an unbiased model. Several techniques of multidimensional analysis were therefore used and the theoretical aspect of linear regression for some particular situations had to be investigated: quasi-colinear "independent variables", measurements with errors, and positive constraints on regression coefficients. A new survey methodology was developed taking account of the new "Integrated Information Systems", which have incidence on all the stages of a consumption survey: organization, data collection, constitution of an information bank, and data processing. (auth)

34525 (CONF-740648-5) TRACHEAL GRAFTS. Griesemer, R.; Kendrick, J.; Nettesheim, P. (Oak Ridge National Lab., Tenn. (USA)). 1974. 20p. Dep. NTIS $4.00.

From symposium on experimental respiratory carcinogenesis and bioassays; Seattle, Washington, USA (23 Jun 1974).

A serial sacrifice study was performed on male rats to determine when a transplanted trachea becomes established and suitable for experimentation. It was found that after transplanting to a subcutaneous site, tracheal grafts survived by diffusion until the 4th day, when the blood supply was reestablished. Established grafts resembled untransplanted tracheas histologically. When exposed to DMBA, the mucosa underwent squamous metaplasia, which progressed to squamous carcinoma as early as 3 months after treatment. A major advantage of the tracheal graft as a research tool is that neoplasia can be induced in a respiratory tissue without interfering with respiration. (auth)

34526 (CONF-740648-6) RESPIRATORY CO-CARCINOGENESIS STUDIES WITH FERRIC OXIDE. A Test Case of Current Experimental Models. Creasia, D.; Nettesheim, P. (Oak Ridge National Lab., Tenn. (USA)). 1974. 25p. Dep. NTIS $4.25.

From symposium on experimental respiratory carcinogenesis and bioassays; Seattle, Washington, USA (23 Jun 1974).

Work on iron oxide Co-carcinogenesis is reviewed. It is noted that results of laboratory studies conducted to date strongly suggest that ferric oxide dust can act as a co-factor in respiratory tract carcinogenesis. The data indicate at least two different mechanisms by which these otherwise fairly inocuous particles might exert their effect: 1) by retarding carcinogen clearance (this applies to conditions in which the carcinogen is adsorbed to the

particle surface) 2) by causing cytopathological effects (irritation, enhanced cell proliferation) at the site of deposition. These findings suggest that otherwise rather harmless particulate air contaminants might play a significant role in the pathogenesis of lung cancer. (auth)

34527 (CONF-740826-2) LIFE HISTORY AND ECOLOGY OF PELTOPERLA MARIA (PLECOPTERA: PELTOPERLIDAE) IN A SMALL SPRING-FED STREAM. Elwood, J. W.; Cushman, R. M. (Oak Ridge National Lab., Tenn. (USA)). 1973. 15p. Dep. NTIS $4.00.

From international association of limnology meeting; Winnipeg, Canada (22 Aug 1974).

The life history and general ecology of Peltoperla maria in an east Tennessee spring stream are described. Information is included on sampling methods, life cycles, and distribution. (JRD)

34528 (COO-3140-33) TOXICOLOGY AND METABOLISM OF NICKEL COMPOUNDS. Comprehensive Report, December 1, 1968–November 30, 1974. Sunderman, F. W. Jr. (Connecticut Univ., Farmington (USA). School of Medicine). 1974. Contract AT(11-1)-3140. 27p. Dep. NTIS $4.50.

Research in the following major areas of investigation is reported: molecular mechanisms of nickel toxicity; nickel carcinogenesis; nutritional role of nickel; pathological alterations of nickel metabolism; protein-bound nickel; ultrafilterable nickel complexes; kinetics and distribution of Ni(II) in animals; nickel analyses; environmental influences upon nickel metabolism in man; and research on other trace metals. (ERB)

34529 (COO-3167-109, pp vp Paper 4) SEMEN CHARACTERISTICS IN THYROIDECTOMIZED STALLIONS. Lowe, J. E.; Baldwin, B. H.; Foote, R. H.; Hillman, R. B.; Kallfelz, F. A. 1974.

In applications of radioisotope techniques to clinical veterinary medicine. Annual progress report.

Three quarter horse type stallions were surgically thyroidectomized (Thx) at 18 months of age. Weekly semen collection was started in the three Thx and three control stallions at 25 months of age and concluded at 39 months. The induced state of hypothyroidism in young stallions was found to have a depressing effect on libido and general animation. The depression of libido and general animation was correctable by thyroprotein supplementation. Semen characteristics showed little or no alteration in the hypothyroid stallions. (auth)

34530 (LA-5719-PR) APPLICATION OF CELL ANALYSIS AND SORTING TECHNIQUES TO DISEASE DETECTION. Progress Report, July 1, 1973–June 30, 1974. Cram, L. S. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1974. Contract W-7405-eng-36. 6p. Dep. NTIS $4.00.

Several strains of Newcastle disease virus (NDV) have been isolated from chickens in the United States; most strains are relatively harmless and result only in loss of production. Recent outbreaks (March 1972 to present) of a new and virulent strain that produces death in less than six days have necessitated a rapid differential test for identification of this particular strain. The plaque assay designed to differentiate velogenic strains of NDV requires seven to ten days for completion. We have developed a rapid differential assay that requires about two to three days to complete. (auth)

34531 (LA-tr-73-25) AUTOMATION IN QUANTITATIVE CTOLOGY WITH THE PULSE CYTOPHOTOMETER. Goehde, W. Translated from Ges. Bekampf. Krebakr. Nordheim-Westfalen; 6: 255-276(1972). 28p. Dep. NTIS $4.50.

34532 (LA-tr-74-28) USE OF ^{15}N IN THE STUDY OF NITROGEN UPTAKE AND METABOLISM IN PLANTS. Gyrbuchev, I.; Dinchev, D. 1974. Translated from pp 63-78 of STI/PUB-161. (CONF-670852-2). 27p. Dep. NTIS $4.50.

From symposium on the use of isotopes in studies of nitrogen metabolism in the soil-plant-animal system; Vienna, Austria (28 Aug 1967).

As a result of the studies conducted, using isotopic nitrogen, the following can be concluded: depending on soil conditions, in a greenhouse test, test, plants metabolized 47 to 56% and, in a field test, from 40 to 43% of the nitrogen introduced in the form of mineral fertilizers. The source of more than half the nitrogen taken up in fertilized plants is soil nitrogen; nitrogen-fertilized plants use a larger amount of soil than unfertilized ones; the nitrogen introduced into the soil causes additional mobilization of soil nitrogen; a year after introduction of nitrogen, the nitrogen fixed by soil microorganisms changes into forms which are almost inaccessible to plants; nitrogen introduced into the soil is rapidly taken up into plants and incorporated in various nitrogen compounds, in the following sequence: nonprotein organic nitrogen, constitutive proteins, chlorophyll and reserve proteins; in the bound amino acids, the greatest amount of isotopic nitrogen was determined in alanine, threonine, serine, glycine, and dicarboxylic acids—glutamic and aspartic; phosphorus fertilizer increases the amount of isotopic nitrogen incorporated in various amino acids; incorporation in amino acid synthesis becomes more complete when it is introduced in later phases of development of plants; chlorophyll and constitutive proteins turn over nitrogen at the greatest rate; the greatest amount of the nitrogen introduced is incorporated in the glutenin and proline fractions of wheat grains; the smallest amount was determined in the albumin and globulin fractions. (auth)

34533 (LF-tr-93) SPONTANEOUS TUMORS OF THE SYRIAN GOLDEN HAMSTER. Dontenwill, W.; Chevalier, H. J.; Harke, H. P.; Lafrenz, U.; Reckzeh, G. Translated from Z. Krebsforsch.; 80: 127-158(1973). 22p. Dep. NTIS $4.25.

Summary of our experimental results and the literature available reveal an overview of tumor incidence and the types of tumors in the Syrian golden hamster. The studies repeatedly show that a clear statement as to the question of experimentally caused induction of tumors can be made only with very large numbers of animals. This is particularly true if a low incidence of tumors is observed. Obviously, adrenal tumors, which are among the most common tumors of the Syrian golden hamster, are part of the genetic pattern. What significance virus infections have in the tumor colonies used to observe the appearance of, for example, tumors in the lymphoreticular tissues, cannot be estimated from the present findings. As regards the histologic structure of the tumors found, they were closely comparable to the tumors of humans. Apparently the hamster is especially well suited for experiments to test the carcinogenic effects of certain substances like nitrosamine and hydrocarbons, as well as inhalable carcinogenic mixtures. (auth)

34534 (LF-tr-94) COMPARATIVE PATHOLOGY OF PULMONARY CARCINOMAS IN DOMESTIC ANIMALS. Stuenzi, H. Translated from Pathol. Microbiol.; 39: 358-363(1973). 7p. Dep. NTIS $4.00.

Primary pulmonary carcinomas which are closely similar to those in humans with respect to histologic structure and age distribution appear in the dog and cat. Although the relative distribution of the several types of cancer varies widely, in domestic animals adenocarcinomas clearly predominate. Epidermoid carcinomas are very rare in the dog and cat. A small number of anaplastic parvicellular and macrocellular forms of cancer were seen in the dog, but were not observed in the cat. As compared to the other carcinoma types, they appear at an earlier age. There does not seem to be a sex disposition in the animals. In spite of the relatively limited numbers of animals, studies like this with domestic animals seem to us to have epidemiologic and etiologic significance. (auth)

34535 (NYO-3406-7) QUANTITATIVE STUDIES OF WEAK LIGHT SOURCES IN BIOLOGICAL SYSTEMS BY MEANS OF AN IMAGE INTENSIFIER. Reynolds, G. T. (Princeton Univ., N. J. (USA). Palmer Physical Lab.). 1968. Contract AT(30-1)-3406. 30p. (CONF-680207-9). Dep. NTIS $4.50.

From 11th scintillation and semiconductor counter symposium; Washington, District of Columbia, USA (28 Feb 1968).

Several image intensifier systems were calibrated for gain and single electron detection efficiency. When these intensifiers are coupled to conventional microscopes the combined system provides sufficient light to allow photographic recording in short exposure times of certain biological systems that would ordinarily not be photographable or would require undesirably long exposure times. The photographs also provide quantitative information on the amount of light entering the microscope objective. Experiments are described in which an image intensifier microscope system was used to study bioluminescence, providing data on the temporal and spatial distribution of light output in several organisms. Other experiments are described in which the location of weak radioactive tracers was possible in short exposure times, using thin overlying scintillators to provide the necessary light. System requirements are discussed for the extension of this technique to x-ray studies and fluorescence microscopy. (auth)

34536 (NYO-4051-23) TOXICOLOGY OF NICKEL CARBONYL. Progress Report. Sunderman, F. W. Jr. (Connecticut Univ., Newington (USA). Dept. of Lab. Medicine). 1 Aug 1971. Contract AT(30-1)-4051. 11p. Dep. NTIS $4.00.

Research is reported on isolation of a Ni α_2-macroglobulin from rabbit serum, nickel deprivation in chicks, effects of nickel carbonyl on hepatic ATP, rapid induction of sarcomas in rats by combination nickel sulfide and 3, 4 benzpyrene, measurement of serum nickel concentrations in hospital patients, estrogen induction of ceruloplasmin synthesis, carcinogenesis in rats following intravenous injection of nickel carbonyl, and development of a tube furnace. (JRD)

34537 (ORNL-TM-4559) OPTICAL PROPERTIES OF NUCLEIC ACID BASES. Tang, I. I.; Arakawa, E. T.; Williams, M. W.; Hamm, R. N.; Emerson, L. C.; Birkhoff, R. D. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 65p. Dep. NTIS $6.25.

Thesis. Submitted to Univ. of Tennessee, Knoxville.

The optical properties are reported for the nucleic acid bases adenine, thymine, cytosine, and guanine in the energy range from 4 to 10 eV. Thin films of these bases were sublimed onto CaF_2 or glass in vacuum, exposed to the atmosphere while being transferred to the reflectometer, and measured with the films maintained in vacuum. The imaginary part of the refractive index, k, was determined from measurements of transmittance as a function of film thickness for each experimental wavelength. There is virtually no experimental scatter associated with the k data for a given film, but the magnitude of k is not reproducible from one film to another especially in the shorter wavelength region. Inhomogeneities in the films, surface irregularities, and contamination are some of the factors that could be involved. Further experimentation on conditions affecting film structure must be done. Representative k values obtained from transmission measurements combined with the measured reflectance at 20° photon angle of incidence were then used to calculate n, the real part of the refractive index as a function of wavelength. The dielectric constant, $\epsilon = \epsilon_1 + i\epsilon_2$, and the energy loss function, $-\mathrm{Im}(1/\epsilon)$, were then calculated from the n and k values by the relations $\epsilon_1 = n^2 - k^2$, $\epsilon_2 = 2nk$, and $-\mathrm{Im}(1/\epsilon) = \epsilon_2/(\epsilon_1^2 + \epsilon_2^2)$. The energy loss function calculated from the optical constants is compared directly with the energy loss spectra of 25 keV electrons passing through thin films of nucleic acid bases reported in the literature. It was found that there is fair agreement between the structure in $-\mathrm{Im}(1/\epsilon)$ and the structure in the electron energy loss spectra. Structure in ϵ_2 and $-\mathrm{Im}(1/\epsilon)$ as a function of photon energy was interpreted in terms of $\pi \rightarrow \pi^*$ molecular excitations and collective oscillations. (auth)

34538 (ORO-4310-3) PRIMARY LIGHT HARVESTING SYSTEM: PHYCOBILISOMES AND ASSOCIATED MEMBRANES. Progress Report, October 14, 1973–December 31, 1974. Gantt, E. (Smithsonian Institution, Rockville, Md. (USA). Radiation Biology Lab.). 1974. Contract AT(40-1)-4310. 8p. Dep. NTIS $4.00.

34539 (SRO-643-9) SUMMARY PROGRESS REPORT, SEPTEMBER 1, 1971–JUNE 30, 1974. (Georgia Univ., Athens (USA). Dept. of Botany). 1974. Contract AT(38-1)-643. 21p. Dep. NTIS $4.25.

Research on methods of isolating polyribosomes leading to ribosome preparation is summarized. Data and information are included on activation and inactivation mechanisms in protein synthesis, ribosome activation in corn leaves, auxin activation of ribosomes, and polyadenylate sequence in RNA. (JRD)

34540 (UCD-472-121, pp 24-26) BONE MINERAL IN THE DEVELOPING BEAGLE: IN VITRO ANALYSES. Fisher, G. L.; Lee, T. D. Jun 1974.

In annual report, fiscal year 1974.

Photon absorptiometric techniques were utilized to measure bone mineral changes in femora from developing beagles. When bone mineral content and bone width were plotted against age and fit to a power function, the bone ends were found to develop more rapidly with an exponent 1.6 times greater than the diaphyseal sites. The areal density changes with age were fit with a linear equation; the ratio of slopes for bone ends to diaphysis with age was 1.7. These data allow for the quantitation and modeling of bone mineralization in the beagles. (auth)

34541 (UCD-472-121, pp 100-104) TRACE ELEMENTS IN LIVERS OF DEVELOPING BEAGLES. Fisher, G. L.; Perry, S. K. Jun 1974.

In annual report, fiscal year 1974.

The liver concentration of the essential elements K, Fe, Cu, Zn, and Se and the non-essentials Rb and Br were determined in specimens from developing beagle pups. Changes in elemental concentrations with age were fit to various mathematical functions. Significant decreases past 40 days of age which may relate to dietary changes were found for Zn, Se, Br, and Rb. (auth)

Materials

34542 (CEA-R-4555) STUDY OF METALLIC INTERFACES. Job, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. de Metallurgie et d'Etude des Combustibles Nucleaires). Aug 1974. 75p. (In French). Dep. NTIS (US Sales Only) $6.75.

The diffusion of the radiotracer ^{59}Fe along a silver-iron interface was investigated for 500 < T°C < 650. In this temperature range, the variation of the diffusion parameter may be fitted by the relation: $Di\ \delta = 2.37\ 10^4 \exp -41200/RT$. These values are compared with the values of surface and grain boundary diffusion of silver and iron. Mass-transport methods (scratch smoothing and grain boundary grooving) to solid-solid interface were extended. The methods lead to a value of $Di^* \delta \gamma i$ ($Di^* \delta$ is the effective diffusion parameter and γi the interfacial energy). Knowing the value of $\gamma i = 4000$ ergs/cm^2 from the equilibrium angle method, the value of $Di^* \delta$ was derived. (tr-auth)

34543 (COO-3161-24) MACROSCOPIC ENGINEERING PROPERTIES OF POLYCRYSTALLINE MATERIALS. I. General Methods. Gubernatis, J. E.; Krumhansl, J. A. (Cornell Univ., Ithaca, N. Y. (USA). Lab. of Atomic and Solid State Physics). Aug 1974. Contract AT(11-1)-3161. 36p. Dep. NTIS $5.00.

The formal application is outlined of integral equation methods (Green's function techniques) to the systematic computation of the effective elastic properties of polycrystalline materials from the specification of the statistical distribution of elastic properties of the constituent grains (or pores). These methods are not entirely new, but by the use of developments in the study of the electronic properties and lattice dynamics of disordered solids, various methods are compared on a common footing and indicate their limitations. Some details for the actual application of these methods are also presented. (auth)

34544 (GKSS-74/E/25) GENERAL CRITERIA FOR THE DESIGN OF LOOP INSTALLATIONS FOR CORROSION STUDIES FOR THERMAL SEA WATER DESALINATION. Froehner, K. R. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). 1974. 33p. (In German). Dep. NTIS (U. S. Sales Only) $4.75.

34545 (JINR-P4-8067) THEORY AND CLASSIFICATION OF COLOR SYMMETRY GROUPS. I. P Symmetry. Koptsik, V. A.; Kotsev, I. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The classification of groups of color symmetry is suggested in three main "types": P-, Q-, and W-symmetry. The theory of P-symmetry is described and the total list of groups of this kind is given that are isomorphic to the point groups. (tr-auth)

34546 (JINR-P4-8068) THEORY AND CLASSIFICATION OF COLOR SYMMETRY GROUPS. II. W Symmetry. Koptsik, V. A.; Kotsev, I. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The group theoretical principles for color symmetry groups for the symmetry of a new type-W-symmetry were described. It is shown that these groups are subgroups of wreath products $P_2G \equiv$ PwrG. Theory of the W-symmetry groups with noninvariant classical subgroup is developed, the existence of two classes of such groups is demonstrated, and total list of groups of this kind that are isomorphic to the point groups is given. (tr-auth)

34547 (KFKI-74-38) CALCULATION OF THE FARADAY SIGNAL OF A MAGNETO-OPTICAL MEMORY IN THE PRESENCE OF MAGNETIC CIRCULAR DICHROISM. Ronaky, J.; Bergou, J. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1974. 9p. Dep. NTIS (US Sales Only) $4.00.

The polarization of a light field after passing through a circularly birefringent material is calculated, and the results are used to investigate the readout problem in magneto-optical memories. It is shown that the circular dichroism has no effect on the readout efficiency in three different readout configuration possibilities. (auth)

34548 (KFKI-74-43) ABSENCE OF THE FINITE CONDUCTION ELECTRON POLARIZATION IN DILUTE ALLOYS. Zawadowski, A.; Gruener, G. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1974. 8p. Dep. NTIS (US Sales Only) $4.00.

It is shown, by analyzing the Schrieffer-Wolff transformation in HF approximation, that the finite conduction electron polarization, obtained from the s-d model is spurious. (auth)

34549 (MHSMP-74-19A) HE FRICTION SENSITIVITY. Period Covered: April–June 1974. Van Velkinburgh, J. H. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1974. 12p. Dep. NTIS $4.00.

For Univ. of California Lawrence Livermore Lab.

Several additional instrumented skid tests were done on RX-04-EI (98/2 HMX/Vistanex) and RX-04-EJ (99/1 HMX/Vistanex). An extensive series of instrumented skid tests was done on RX-04-EO (95/5 HMX/Estane 5702-F2) and RX-04-EN (95/5 HMX/Estane 5702) at a 45° impact angle. Several partial reactions were observed. Evaluation of the mechanical response by means of

vertical drop testing and frictional sensitivity by skid testing of 45 kg billets of PBX 9404, LX-04-1 and LX-14-0 was completed. (auth)

34550 (MHSMP-74-19-C) FORMULATION AND PROCESSING OF LX-14 PBX. Period Covered: April–June 1974. Stallings, T. L.; Osborn, A. G.; Quinlin, W. T. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1974. 4p. Dep. NTIS $4.00.

For Univ. of California Lawrence Livermore Lab.

Two batches of the HMX/Estane PBX were prepared for compatibility and thermal aging studies and to complete skid test sensitivity evaluation series. (auth)

34551 (MHSMP-74-19-D) MECHANICAL PROPERTIES OF HIGH EXPLOSIVES. Period Covered: April–June 1974. Johnson, H. D. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1974. 15p. Dep. NTIS $4.00.

For Univ. of California Lawrence Livermore Lab.

Creep testing appears to be a much more sensitive test for the evaluation of HE. Thermal cycling of HE at ambient pressure deteriorates the mechanical properties and decreases the density. The compression test results showed that the strain at 24 hours for specimens conditioned by this method increased approximately 25%. (auth)

34552 (MHSMP-74-19-E) EXPLOSIVES PERFORMANCE. Period Covered: April–June 1974. Kramer, P. E. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1974. 6p. Dep. NTIS $4.00.

For Univ. of California Lawrence Livermore Lab.

A PBX 9404 cylinder shot was fired and observed with a Beckman & Whitley Model 770 streak camera for purpose of comparison to shots observed on the Pantex Model 101. The cylinder broke up early, resulting in a record of limited usefulness. The C–J pressure series (Magnesium Plate Method) on RX-04-EE was completed. Pantex analysis indicates a pressure of 35.6 GPa. (auth)

34553 (MHSMP-74-29) PARTICLE CHARACTERIZATION OF CALCIUM CHROMATE AND TITANIUM. Period Covered: April–June 1974. Duncan, A. A. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1974. 6p. Dep. NTIS $4.00.

For Sandia Labs., Albuquerque, N. Mex.

The characterization of calcium chromate and titanium has been completed. Characterization was done by microscopy and gas adsorption. Distribution analysis of calcium chromate results are the basis for distinguishing calcinated from non-calcinated samples since the non-calcinated samples have length distribution with low coefficient of skewness and excess. (auth)

34554 (SLA-74-5160) TRANSPORT OF OXYGEN IN AMORPHOUS Ge THIN FILMS DURING ANNEALING. Knotek, M. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 24p. (CONF-741015-4). Dep. NTIS $4.25.

From 21st national symposium of the American Vacuum Society; Anaheim, California, USA (19 Oct 1974).

Both direct and indirect evidence has suggested that low-density a-Ge films grown at substrate temperatures $T_s < 100°C$ are porous or void-filled and that high-density films grown at $T_s > 150°C$ are free of such voids. This evidence includes the results of electron microscopy, where the presence or absence of such voids was directly detected, and the effects of annealing on the dc electrical transport properties where the sensitivity to small quantities of gas ($\approx 10^{-9}$ torr) present during annealing suggested a porous nature for low T_s films. In this study, using Auger Electron Spectroscopy in conjunction with ion sputter etching, it has been determined directly that the structure of low T_s films is such as to promote rapid movement of oxygen through the films, suggesting a porous nature. These films quickly saturate at 1 to 3 at. % O throughout the bulk when exposed to 10^{-7} torr of O_2 at 150°C. On the other hand, high T_s films show negligible oxygen movement. Similar annealing for high T_s films results in no detectable level of O after a shallow surface layer. The results suggest that the discrepancies in optical and electrical properties reported in the literature for annealed a-Ge are due to oxygen contamination. (auth)

34555 (UCID-16567) DIELECTRIC MATERIALS DEVELOPMENT. Peck, L. E.; Kirzey, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Jun 1974. Contract W-7405-eng-48. 20p. Dep. NTIS $4.00.

Films and film forming were evaluated for application to the fabrication of dielectric components. Du Pont's Kapton H and Kapton XH649 were compared. Kapton H shrunk more in the machine direction and Kapton XB 649 shrunk more in the transverse direction; the total shrinkage was less for Kapton XH649 than for Kapton H. Kapton H hats, made by vacuum/pressure forming, were inspected for change in contour at various temperatures and dwell times. (auth)

34556 (UCRL-51569) STATISTICAL MECHANICAL BASIS FOR CALCULATION OF DEFECT CONCENTRATIONS IN SOLIDS. Hardy, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Apr 1974. Contract W-7405-eng-48. 14p. Dep. NTIS $4.00.

The application of the techniques of molecular dynamics to the calculation of the entropy and free energy of a lattice with defects is considered in detail. Specifically, the problem of calculating the equilibrium number of Frenkel defects in a lattice is reduced to one of evaluating microcanonical averages. The most probable number of Frenkel defects in a lattice of fixed volume at temperature T is $\hat{n} \propto e^{-\Delta F/2\kappa T}$, where ΔF is the change in free energy due to one defect, and κ is Boltzmann's constant. A more rigorous statistical mechanical derivation is given in addition to the usual thermodynamic arguments leading to this formula. The coupling parameter method and the harmonic approximation method for determining ΔF are presented. A review is given of the equipartition formula for the temperature and the phase function expression for the pressure. The virial and the phase function expressions for the pressure for a system with periodic boundary conditions are discussed. (auth)

Physics and Engineering

34557 (INIS-mf-1366) APPLICATION OF CAMAC TO THE EVALUATION OF AXIAL FLOW FANS. Gertenbach, W. P. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). [nd]. 5p. INIS.

From 1st international symposium on CAMAC in real-time computer applications; Luxembourg (4 Dec 1973).

A CAMAC instrumentation system was used in an automatic computer-based control and data acquisition system for the evaluation of axial flow fans. The system measures fan characteristics at constant fan speed and static-pressure ratio between fan inlet and outlet. An evolutionary operations (EVOP) strategy was employed for controlling fan speed and static-pressure ratio. (INIS)

34558 (INP-819/PL) 5TH ALL-POLISH SEMINAR ON NUCLEAR MAGNETIC RESONANCE AND ITS APPLICATIONS, KRAKOW, DECEMBER 1-2, 1972. Part I. (Institute of Nuclear Physics, Krakow (Poland)). Dec 1972. 168p. (In Polish and English). (CONF-721238-). Dep. NTIS (US Sales Only) $11.50.

The 17 papers presented at the conference are compiled. The papers reported the experimental results of the measurement of nuclear magnetic resonance in many organic compounds and complexes and the use of this method for structural analysis. The design of apparatus for NMR measurements is also considered. Nuclear quadrupole resonance measurements are reported. (JSR)

34559 (IS-3469) ALGORITHM FOR AUTOMATIC INDEXING AND BRAVAIS LATTICE SELECTION. The Programs BLIND and ALICE. Jacobson, R. A. (Ames Lab., Iowa (USA)). Sep 1974. Contract W-7405-eng-82. 76p. Dep. NTIS $5.45.

An algorithm is described that was developed and implemented in PL/1 to automatically determine the indices and other reciprocal lattice information from positions of a dozen or so reflections obtained from either four-circle diffractometer or precession-film methods. Output includes the indices, reduced cell dimensions, and the reduced cell scalars for ready Bravais lattice determination. Two versions of the program are described. One version, ALICE, is designed for use on a computer supporting PL/1 and having capability for interactive control of a four-circle diffractometer. The other version, BLIND, is designed for use when interactive control is not feasible. The report contains descriptions, operating instructions, and documentation for both ALICE and BLIND. (auth)

34560 (JINR-E4-8016) INFLUENCE OF UNIAXIAL AND BIAXIAL ANISOTROPY ON THE SPECTRUM IN SYSTEMS WITH BIQUADRATIC EXCHANGE. Westwanski, B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

The spectrum of elementary excitations in systems with Heisenberg and biquadratic pair interactions, uniaxial and biaxial crystal fields, and in an external magnetic field consists of 2S branches connected with changing the quantum magnetic number, S^z, by one, and $2S - 1$ branches corresponding to $|\Delta S^z| = 2$. By applying the diagrammatic technique, the expressions for the spectrum for S = 1 are obtained. (auth)

34561 (JINR-P4-8086) GENERALIZED PHASE SHIFTS FOR TWO NONOVERLAPPING POTENTIALS. John, W.; Ziesche, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The theory of elastic scattering by a cluster of nonoverlapping potentials and its application to the electron theory of condensed matter are considered. As a simple example the generalized phase shifts for two nonoverlapping potentials are calculated. (tr-auth)

34562 (MHSMP-74-19-G) NON-CONTACT EXTENSOMETER. Tash, J. E. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 20 Aug 1974. 9p. Dep. NTIS $4.00.

For Univ. of California Lawrence Livermore Lab.

The development of a non-contact extensometer having a resolution of 0.003 mm or better appears to be feasible. Requirements for such a device would include a laser possessing a higher output intensity and better stability than the one employed. Time interval counters having a resolution of 0.01 μsec or better should be employed (the system used 0.1 μsec time interval counters for reasons of expediency, building in an uncertainty of approximately ±0.0002 mm). A practical unit would require the development of the reflective marker system to a sufficiently high degree of resolution or a simple way of attaching detectors to the test specimen in proper alignment, without significantly changing the mechanical characteristics of the surface to which they were attached. (auth)

34563 (ORNL-4986) TECHNIQUE FOR DETERMINING THERMAL AND ELECTRICAL CONDUCTIVITY AND ABSOLUTE SEEBECK COEFFICIENT BETWEEN 300 AND 1000 K. Moore, J. P.; McElroy, D. L.; Graves, R. S. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 47p. Dep. NTIS $5.45.

A guarded-longitudinal-heat-flow technique for measuring thermal conductivity (λ), electrical resistivity (ρ), and Seebeck coefficient (S) on small rods (1 cm diam by 7 cm long) between 300 and 1000 K is described in detail. The thermal conductivity of the powder insulation in the system annuli was low enough to permit use of the thin-rod approximation for calculating λ of metals. Determinate errors were ±0.4% for ρ, ±0.14 μV/K for S respect to platinum, and ±1.3% and ±2.2% for λ at 300 and 1000 K, respectively. The apparatus was tested with an Armco iron reference specimen, which had a λ known to within ±1.9%. One test was performed with the specimen brazed onto heater and heat sink, and results from this test were within the determinate error. Measurements on the reference when it was threaded onto heater and heat sink produced ρ and S results that agreed with those from the brazed specimen to within determinate error but produced λ results that were 2 to 6% above the reference values. The cause of this discrepancy with a threaded specimen is not completely understood but may be indirectly related to the large temperature drop that occurs at the threaded interfaces. (auth)

34564 (SAND-74-0184) CALCULATION OF THE RADIATION PATTERN OF A CONICAL ARRAY OF APERTURE ANTENNAS. Russo, A. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1974. Contract AT(29-1)-789. 21p. Dep. NTIS $4.25.

A ray optics code has been developed to compute the radiation pattern of axially polarized arrays of cone-mounted antennas. Calculations for bare and plasma-covered cones with rectangular aperture and ring slot antennas are compared with experimental patterns. (auth)

34565 (SAND-74-5041) IMPACT TESTING USING A VARIABLE ANGLE ROCKET LAUNCHER. Nunez, H. W. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 7p. (CONF-741006-1). Dep. NTIS $4.00.

From 45th shock and vibration symposium; Dayton, Ohio, USA (22 Oct 1974).

A test facility that uses a rocket-powered sled to launch a test item at an impact target is described. The rail along which the sled is launched is capable of being elevated so that the relative angle between the line of flight and the impact target face can be varied between 90° and near 0°. A 2000-pound test unit can be accelerated to an impact velocity of approximately 200 feet per second. (auth)

34566 (SAND-74-8211) GAS-TRANSFER ANALYSIS. Section A. Introduction to Gas-Transfer Fundamentals. Chenoweth, D. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1974. Contract AT(29-1)-789. 30p. Dep. NTIS $4.50.

The definition of various types of gas-transfer problems is examined and some of the physical phenomena affecting them are discussed. The governing dimensionless parameters and their use as well as the common terminology and assumptions used in analysis are also discussed. It is shown, using an equilibrium-state analysis, that the maximum possible importance of reservoir heat transfer at pressure equilibrium can be determined prior to solving a transient gas-transfer problem. (auth)

34567 (UCID-15841) NEW RAPID METHOD FOR DETERMINING 1/METER-CANDLE-SECOND PHOTOGRAPHIC SPEEDS. Herrmann, W. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1971. Contract W-7405-Eng-48. 13p. Dep. NTIS $4.00.

A nomograph for use in quickly and accurately determining the 1/meter-candle-second photograph speed is presented. (auth)

34568 (UCID-16577) GENKIN-I: A GENERAL KINETICS CODE: ATMOSPHERIC APPLICATIONS. Gelinas, R. J.; Dickinson, R. P. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Aug 1974. Contract W-7405-eng-48. 109p. Dep. NTIS $8.50.

A first version of a multipurpose, semi-automatic code for setting up and reliably solving large coupled sets of stiff, nonlinear kinetic equations is described. The present code, GENKIN-I, features and utilizes advanced variants of the basic GEAR method to stably and accurately solve large sets of stiff nonlinear differential equations. The present reaction library that interfaces with the general kinetics code emphasizes atmospheric chemical and radiative interaction processes. Reaction libraries for other applications, such as gas lasers, ionic systems, combustion kinetics, coal, and other fuel conversion processes, and biological kinetics can be interfaced to the general kinetics code. (MCW)

34569 (Y-1954) DEVELOPMENT OF A MACHINE TOOL SYSTEM WHICH UTILIZES ULTRASONIC THICKNESS GAGING TO MACHINE THE WALL OF CYLINDERS TO CONSTANT THICKNESS. Carey, L. E. (Oak Ridge Y-12 Plant, Tenn. (USA)). 9 Oct 1974. Contract W-7405-eng-26. 55p. Dep. NTIS $4.00.

A machine-tool system which utilizes ultrasonic gaging to machine the walls of cylinders to a constant thickness is described. The machining system is used to machine the outside surface of a cylinder after the inner surface has been machined by conventional methods. One ultrasonic transducer and two thickness gages are used to continuously measure the distance to the inner surface of a cylinder. The pulsed-echo technique is used to measure thicknesses, and the output of the thickness gages continuously controls the position of the tool. A fast-response electrohydraulic servo swiftly moves the cutting tool in response to the movement of the back surface of the rotating cylinder. The cutting tool is continuously controlled to maintain constant distance from the inner surface of the cylinder as it rotates in a lathe. The front surface of the cylinder is machined identically to the back surface, and the cylinder thus has a wall of uniform thickness. (auth)

34570 (Y-1958) SEMIAUTOMATIC LVDT DISPLACEMENT TRANSDUCER TESTING SYSTEM. Bearden, L. E. Jr. (Oak Ridge Y-12 Plant, Tenn. (USA)). 7 Oct 1974. Contract W-7405-eng-26. 19p. Dep. NTIS $4.00.

A semiautomatic system has been built to test the electrical and mechanical properties of linear variable differential transformer (LVDT) transducers. From these measurements, the transducer pretravel, overtravel, maximum percent nonlinearity, null voltage, and half-range output voltage are calculated and outputted in a report format. Displacement measurements are made with a laser interferometer; output/input voltage ratio measurements are made using an AC bridge circuit. The system accuracy is better than ±0.02% at a frequency of 5 kHz. (auth)

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